

LJ-77-15

A WORKSHOP TO ASSESS RESEARCH
RELATED TO THE
PORPOISE/TUNA PROBLEM
February 28 & March 1-2

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Preface

An objective of the La Jolla workshop was to obtain a report that could be used to bring everyone (Congressmen, environmentalists, scientists, etc.) up-to-date on the current status and plans for research related to the tuna-porpoise problem. Certain information, not discussed during the workshop, has been included in order to provide a more useful and comprehensive document. The structure of the report closely resembles the sequence of the workshop (Section 1.2 of the Introduction contains the workshop agenda).

A glossary of seining terminology has been included in Appendix V. Persons not familiar with the gear and methods used in the tropical tuna purse seine fishery will find this section useful in better understanding essential aspects of the report.

References to background data have been provided in the text of the report where applicable. A bibliographical Appendix has been included for those persons desiring more complete published information on specific topics contained in the report. Reports concerning National Marine Fisheries Service chartered research cruises (see Section 2.1 for abstracts) are being compiled in a volume entitled National Marine Fisheries Service Chartered Research Cruise Reports, Porpoise/Tuna Program; this volume will be available from the National Technical Information Service (NTIS). Requests for copies should be directed to:

National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161

In a sincere effort to avoid the introduction of editorial bias, the sections contained herein reflect as accurately as possible the statements and claims of those who presented topics during the workshop. Consequently, the inclusion of independently submitted material in this report does not constitute Marine Mammal Commission or National Marine Fisheries Service endorsement, either in terms of merit or authenticity.

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1.0 INTRODUCTION

1.1 Introduction and Background

Thousands of porpoise have been incidentally killed and injured each year in the yellowfin tuna purse seine fishery because of the practice of "setting on porpoise." Incidental mortality and serious injury have caused the diminution of certain porpoise stocks (SWFC Administrative Report No. LJ-76-29). Quotas and regulations have therefore been imposed (*Federal Register*, Vol. 42, No. 40-Tuesday, March 1, 1977). Although new gear developments hold promise for significantly reducing incidental kill (c.f., Coe, J. 1977 - Cruise Report on the Gear Segment of the Research Cruise Aboard the *Elizabeth C.J.*, unpub. cruise rept., SWFC), it is not certain that these gear developments alone will enable the domestic and foreign fleets to meet the goal of the Marine Mammal Protection Act - i.e., to reduce incidental kill and serious injury to insignificant levels approaching a zero mortality and serious injury rate.

Because of the uncertainty, there is a continuing need for research to assess the status of impacted porpoise stocks and to seek further improvements in fishing gear and/or practices. To expedite the search for a solution to the problem, research objectives and methods must be periodically assessed to insure that they are focused

in such a way as to make the best possible use of available resources (financial, human, and logistical). To carry out such an assessment, the Marine Mammal Commission (MMC) and the National Marine Fisheries Service (NMFS) co-sponsored a workshop held at the NMFS Southwest Fisheries Center (SWFC), La Jolla, California on February 28, March 1 and 2, 1977. Invited participants included representatives of the U.S. Navy, the National Science Foundation, the tuna industry, the academic-industrial community, and various environmental organizations. (Appendix I includes a list of attendees; Appendix II contains a copy of the agenda.) Dr. Robert Hofman (MMC) and Mr. John Everett (SWFC) organized the workshop; John Everett served as chairman. Mr. Frank Ralston (SWFC) was charged with arranging all logistics and the preparation of this report.

The purpose of this workshop was to identify data needs, solicit new ideas, and to seek advice on avenues of research which hold the greatest promise for solving the "tuna-porpoise" problem. Persons heretofore not involved in the planning or conduct of the research program were invited to participate. Participants were briefed on the results of the 1976 research program, and on plans for 1977, and were given an opportunity to express ideas and/or present research proposals. The workshop report is to be widely circulated to elicit comments from as wide a segment as possible of interested and knowledgeable persons.

Background

In January 1975, the National Marine Fisheries Service, the Marine Mammal Commission, and the tuna industry (represented by the Porpoise Rescue Foundation) - "sharing an interest in successfully implementing a program to reduce incidental mortality and serious injury of porpoise in the course of commercial fishing operations" - entered into a cooperative agreement in order to make the best use of available funds for research and development. The parties agreed to: 1) exchange and evaluate relevant data; 2) discuss, develop, and coordinate current and future research and development projects; and 3) exchange any other relevant information and views. Since entering into the cooperative agreement, the National Marine Fisheries Service, the Marine Mammal Commission, and the Porpoise Rescue Foundation have expanded and coordinated their research efforts, cooperatively supporting projects such as the Mass Gear Test (see page 25), and the recently completed research cruise aboard the *Elizabeth C.J.* (see pages 28 and 39). Furthermore, the National Science Foundation and the National Wildlife Federation have provided funds for augmenting these studies. As a result of these coordinated and expanded efforts, the fiscal investment for 1976 in "tuna-porpoise" research was more than double that of 1975.

Although the research program has been expanded significantly, there remains concern that perhaps too few people have been involved in

the planning and conduct of the program. Representatives of Project Monitor (a consortium of environmental groups) and the Navy approached the Marine Mammal Commission in August of 1976, suggesting that a workshop be convened to solicit advice from a broader spectrum of the scientific-technical communities. The Commission noted that it was planning a workshop for late February, at which point it would be possible to make use of the preliminary results of research carried out during the cruise of the *Elizabeth C.J.*, and suggested it would be appropriate and desirable to include a broader spectrum of knowledgeable and interested persons in this meeting to review and evaluate the tuna-porpoise research program.

The final objectives of the workshop were to: 1) review and evaluate the results of research carried out prior to and during 1976; 2) solicit advice and proposals from persons heretofore not involved in the planning or conduct of the research program; and 3) to critique and make recommendations concerning plans for future research. Participants were asked to identify all promising avenues of research, without considering the possibility that the industry might not provide a dedicated vessel (see Appendix II).

1.2 Workshop on Research Related to the Tuna/Porpoise Problem

February 28, 1977

9:00 - 9:05 Welcome - I. Barrett

9:05 - 9:10 Background and Charge to the Group - R. Hofman

9:10 - 9:25 Overview of problems and research program - J. Everett

Gear Research

9:25 - 9:40 NMFS gear research: background, emphasis, present status -
R. McNeely

9:40 - 10:00 1976 mass gear test - R. McNeely/F. Alverson

10:00 - 10:10 *Elizabeth C.J.* gear results - R. McNeely / J. Coe

10:10 - 10:30 Other NMFS gear studies - R. McNeely

10:30 - 10:45 Coffee Break

10:45 - 11:00 Porpoise Rescue Foundation: background, emphasis, gear
research - F. Alverson

11:00 - 11:15 Del Monte Corporation gear research - C. Norgaard

11:15 - 11:30 Use of vinyl panels in the backdown area - J. Gonsalves

11:30 - 11:50 Questions and discussion - J. Everett

11:50 - 1:20 Lunch Break

Behavioral Research

1:20 - 1:50 Behavioral studies - K. Norris and/or W. Stuntz

1:50 - 2:05 Behavioral observations - K. Pryor

2:05 - 2:35 Acoustic and bioacoustic studies - W. Evans and/or F. Awbry

2:35 - 2:55 Olfactory studies - J. Bardach

2:55 - 3:15 Questions and discussion - J. Everett

3:15 - 3:30 Coffee Break

Agenda Date: 2/27/77

Other NMFS Research

- 3:30 - 3:45 Observer program - S. Birk
3:45 - 4:00 Mortality estimation - N. Lo
4:00 - 4:20 Biological research - W. Perrin
4:20 - 4:40 Stock assessment activities and status of stocks - J. Powers
4:40 - 5:00 Questions and discussion - J. Everett

March 1, 1977

1977 Research Program

- 9:00 - 9:30 NMFS 1977 plans - J. Everett
9:30 - 10:00 PRF 1977 plans: dedicated vessel and research plans -
J. Mulligan and/or F. Alverson
10:00 - 10:15 National Science Foundation emphasis, interest and plans
10:15 - 10:30 Marine Mammal Commission emphasis, interest and plans -
R. Hofman
10:30 - 10:45 Coffee Break
10:45 - 12:00 Research Needs in -
 ● Mortality reduction
 ● Assessment of impact of fishery

This time period will be spent identifying data and
equipment needs - J. Everett
12:00 - 1:30 Lunch Break
1:30 - 2:30 Identification of gaps in the present research program
and areas that should be augmented or reduced
2:30 - 5:00 Presentation of new ideas and research proposals
 ● Del Monte Corp - C. Norgaard
 ● Y² Associates - Y. Yamamoto
 ● San Diego State U. and Hubbs/Sea World Research
Institute - F. Awbry and/or W. Evans
 ● University of Hawaii - J. Bardach
 ● University of California, Santa Cruz - K. Norris
 ● NMFS, Seattle - F. Wathne/R. McNeely
 ● Progressive Fishing Enterprises - J. Gonsalves

- James Seabrook
- NMFS, Bay St. Louis - A. Kemmerer
- Woodmont Ltd. - J. Fitzgerald
- Guillen Enterprises - R. Guillen
- Save the Dolphins - S. Minasian
- Others

March 2, 1977

9:00-11:45 Continued presentation of ideas and proposals

11:45-12:00 General session concluding remarks - R. Hofman & J. Everett

2.0 GEAR RESEARCH

2.1 National Marine Fisheries Service Gear Research

Richard McNeely, Jim Coe (1971-1977)

The improved fishing gear and new methods tested and demonstrated during 1976 represent a culmination of approximately 6 years of research directed towards the development of practical and economically feasible methods to reduce incidental porpoise mortalities. Many of the alternatives which were investigated during this period proved to be economically unsound, impractical, or ineffective. However, a chronology of the meaningful events leading up to the current state-of-the-art may be helpful in giving a better understanding of today's advanced methods and gear types. Those ideas that are still alive (i.e., often suggested by concerned citizens or part of the evolutionary stream) are discussed below. More detailed reports for NMFS chartered cruises are available from the National Technical Information Service (see Preface).

2.1.1 The Westport charter (September 1971)

The *Westport* was chartered for the purpose of conducting experimental porpoise rescue methods using 1) a submersible porpoise gate, 2) playbacks of killer whale, *Orcinus orca*, sounds and 3) a cork-line dragged across the net circle.

This 2-day charter took place 8-10 miles off Point Loma (San Diego) and involved schools of common dolphin, *Delphinus* sp. The porpoise gate consisted of an 80-foot rubber tube, 10 inches in diameter that replaced the floats in the backdown area of the net. The tube could be evacuated (sinking the gate) or inflated (raising the gate) by means of a pressurization control system. Although no major mechanical problems were encountered, it was noted that effective positioning of the gate was difficult when sea and weather conditions weren't ideal. In both sets involving porpoise, the net tended to collapse, buckling the corkline. The gate could not be submerged until $\sim 3/4$ of the net had been rolled.

When the gate had been submerged, killer whale sounds were played back utilizing two specialized underwater transducers lowered over the port side. This occurred prior to the backdown operation. The porpoise displayed a marked response to the playbacks, orienting themselves away from the sound source and leaving through the submerged gate in a very-purposeful fashion.

The dragged corkline was observed to be effective in herding the porpoise within the net. However, the captured school couldn't be guided through the submerged gate. When crowded into approximately $1/4$ of the net, the school dove under the corkline (this might have been due to the proximity of the skiff.)

2.1.2 The *Queen Mary* charters (1971 and 1972)

Subsequent follow up tests on the use of killer whale playbacks were conducted aboard the seiner *Queen Mary* in November 1971 and January 1972. The *Queen Mary* was outfitted with the broadcasting equipment used aboard the *Westport*. However, rather than broadcasting from transducers lowered over the side, a through-the-hull transducer was installed on the *Queen Mary*. The purse seine net aboard the *Queen Mary* was not equipped with the submersible gate. Therefore, experimentation aimed at enabling pre-backdown release (combining the use of the gate and playbacks) was not possible; no release area was provided prior to backdown. The playback signals were emitted during the backdown phase of the experimental sets.

There was no statistically significant reduction in mortality for the 18 sets in which the playbacks were used (there were 20 alternating control sets). Shipboard observations indicated that the sounds tended to increase the confusion of the porpoise during backdown. No further tests have been conducted regarding the use of killer whale playbacks.

2.1.3 The *Independence* charters (1972 and 1973)

The tuna seiner *Independence* was originally chartered by the National Marine Fisheries Service (NMFS) in September 1972. Two additional chartered trips were made in December 1972 and January 1973. The

gear-related objectives of these cruises were: 1) to observe the dynamic characteristics of a double-depth, 2-inch Medina panel, 2) to observe the behavior of porpoise and tuna in the seine, 3) to determine possible modifications to gear and/or techniques which could reduce porpoise mortality, 4) to determine if it was practical to herd porpoise within the confines of the seine using a small skimmer net with long corkline extensions, and 5) to conduct observations on causes of porpoise mortality in the seine.

During these cruises, observations were conducted: 1) from the crow's nest, 2) from the bridge, 3) under water, utilizing scuba and snorkeling gear, and 4) from a small rubber raft with an underwater viewing box.

The following useful observations were made during the three chartered cruises of the *Independence*.

- (1) The vertical distribution of porpoise and tuna in the seine was not consistent to a degree that would allow the use of a mid-net purse line to divide the net horizontally.
- (2) The porpoise tended to remain away from the surrounding walls of webbing, unless they were forced into them by entrapment or crowding.

- (3) The porpoise frequently became entangled in the 4 1/4-inch meshes below the double-depth Medina panel.
- (4) The porpoise frequently became entangled in the 2-inch meshes of the Medina panel.
- (5) All the 2-inch meshes at the end of the backdown channel were observed to be fully opened to near-perfect squares during the application of reverse engine power.
- (6) The porpoise did not exhibit panic behavior during the net-hauling operations or during backdown.
- (7) All dead porpoise at the bottom of the net were found entangled in the 4 1/4-inch mesh.
- (8) Live porpoise were seen sinking to the bottom of the backdown channel and resting there several minutes before returning to the surface to breathe.
- (9) The time span of each backdown surge diminished appreciably as the catch of fish and porpoise increased.
- (10) During backdown, with small catches, the corkline at the apex of the backdown channel would sometimes sink to 10 feet, whereas with large catches it rarely sank more than 2 feet.

- (11) Collapse and the resultant entrapment of porpoise in the backdown channel occurred more frequently in sets involving large numbers of porpoise and tons of tuna.
- (12) Delays in net hauling operations caused by gear malfunctions usually resulted in the collapse of the net. The severity of the collapse was proportionally related to the length of time needed to remedy the malfunction.
- (13) Differential current conditions caused canopies to form, extended the stern and bow bends, and reduced the surface area available to the porpoise.
- (14) Although the manpower and speedboat horsepower necessary to prevent collapse was available, it was seldom used.
- (15) The surface area and volume of water available to the porpoise after pursing is primarily determined by the depth of the net, and it is generally independent of the length of the net.
- (16) The surface area afforded by the 10-strip net (maximum depth per strip is 5.9 fathoms) appeared insufficient for large numbers of porpoise (>1,000).

- (17) During backdown, schools of porpoise tend to remain at the end of the backdown channel, while the school of fish tend to move back and forth between the porpoise and the seiner.
- (18) On some occasions the fish surfaced at the end of the backdown channel and drove the porpoise towards the seiner. This precluded further sinking of the corks for fear of losing fish.
- (19) Mortality rates were excessive for those porpoise left in the net at the time backdown was stopped. This was due to crowding and their close proximity to the 4 1/4-inch web during net hauling and sacking-up operations.
- (20) Porpoise sometimes became entangled under the outermost bunch (usually the third bunch).

2.1.4 John F. Kennedy charter (May, June 1973)

The seiner *John F. Kennedy* was chartered entirely for the purpose of conducting gear dynamic studies. Operations were conducted in local waters (San Diego) and did not involve the capture of either porpoise or tuna. The studies were based largely on the information

gained during the cruises of the *Independence*. Some preliminary steps involving tank testing of modeled purse seines had been undertaken prior to the start of the cruise (i.e., examination of rollups and requirements for holding a net open).

The purse cable of the *John F. Kennedy* was replaced with torque-balanced wire rope to test its effectiveness in reducing the incidence of rollups. Rollups are a common gear malfunction which can cause delays, and thereby lead to net collapse and increased kills. Observations indicated that purse line rotation was minimized with the use of the torque-balanced cable. It was estimated that only three rotations were induced throughout the length of the cable during the course of a set. However, problems were encountered with two sections of the purse line adjacent to the centerpiece. These sections were damaged by abrasion and were replaced with conventional cable. Additionally, the pressed-steel sleeves used for forming the eye splices on the joining ends of these sections were found to be cracked (although no parting occurred). Some difficulty with splicing of the torque-balanced cable was noted. However, initial results were promising and it was agreed to leave the experimental cable on board for future use on the fishing grounds.

Adverse current conditions had been identified as a factor leading to canopy formation and net collapse. The skipper's control of

the net would be increased if a better understanding of prevailing current conditions could be provided prior to the set. Two types of differential current indicators were tested prior to every set. One consisted of a weighted bag of fluoresceine dye that left a visible trajectory as it sank. Another used a fluorescent ribbon that was weighted on one end and attached to a float on the other. The ribbon type provided a higher degree of visibility under varying environmental conditions. Both provided a means of detecting the relative magnitude and direction of differential currents. It was concluded that the use of these devices prior to the set was helpful in predicting the shape the net would assume during the set.

Tests were conducted to determine the feasibility of "cutting" the backdown channel into two separate partitions using a "mini-zipper." The attempt to create a dual backdown system (where the porpoise could be separated from the fish for subsequent release) was not perfected to the degree necessary for tests involving live animals. This was due to the recurring tendency of the dual partitions to collapse. Extremely precise maneuvering by the skiff is necessary for this system to perform as planned.

During this charter, a system was developed which allowed the use of speedboats pulling on adjacent bunchlines to maintain adequate surface area within the net. (This becomes critically important when there are complicating factors such as adverse currents, or delays in

the normal set sequence, both of which can lead to collapse and result in excessive porpoise mortality.) Gear malfunctions were simulated in varying set conditions (downwind, cross-wind, and upwind) to investigate the rate and severity of net collapse in each situation. It was noted that the limited speedboat horsepower available was effective in holding the net open, but was not adequate to pull open a net that had already collapsed.

2.1.5 Trinidad charter (October 1973)

The primary objective of this trip was to test innovations designed to prevent net collapse. A torque-balanced purse cable was utilized to further ascertain its effectiveness in reducing the incidence of rollups. The vessel's conventional purse blocks were replaced with larger 20-inch diameter blocks in order to see if they were more compatible with the more-rigid torque-balanced cable. Webbing was seen draped over the purse line during two sets. However, it was easily cleared using pike poles and pursing continued uninterrupted.

Differential current indicators were tested. It was possible for the first speedboat launched to deploy the indicator, then return to the seiner and communicate the magnitude and direction of the current before the last speedboat was ready for the chase. It was hoped that once the bearing of the current had been determined, it would be possible

to "fix" this bearing on the bezel of a set-position compass installed in the crow's nest. It is from this vantage point that the skipper directs the set. However, due to the type of compass used, "fixing" the bearing was awkward and tended to create confusion. The points on the compass were reversed from the type compass used in the pilot house of most fishing vessels.

Further experimentation was conducted with the dual backdown system, but these efforts were abandoned. Those involved were reluctant to shorten the skiff towline to the extent necessary for achieving the required degree of maneuverability. Shortening the towline would expose the skiff driver to extreme danger if the line were to snap during towing.

Observations regarding the use of speedboats to hold the net open were very encouraging. In one instance a collapse was averted when the net had been set 180° out of position relative to a strong current. This set involved a large school of porpoise that had all gone into the bow bend. Adequate surface area was maintained by the timely deployment of speedboats pulling on the reversed bunchlines.

The impact on total porpoise mortality caused by the fear of loss of fish was more fully appreciated (specifically when the fish got behind the porpoise in the backdown channel and drove the porpoise toward the seiner.)

2.1.6 John F. Kennedy charter (November 1973)

The NMFS large-volume purse seine was tested during this charter of the *John F. Kennedy*. This net was a radically modified version of the conventional purse seine then in use by the fleet. Its design characteristics included: 1) 17 strips of depth (allowing greater surface area), 2) extensively tapered wings on either end of the net, 3) the extensive use of lightweight No. 24 twine in the construction of major areas of the seine, 4) the use of smaller 1 1/2-inch mesh in the porpoise safety panel, 5) tighter "hangings" connecting the net to the corkline floats and handholds, and 6) the porpoise safety panel was extended in length and made three strips deep.

The use of the smaller mesh and tighter "hangings" appeared to greatly reduce the incidence of individual entanglement during backdown. It was also noted that the elapsed pursing time was reduced to ~17 minutes per set. At no time did the corkline sink during the pursing operation even though this is considered very fast pursing. A torque-balanced purse line functioned perfectly throughout the charter. There were no rollups in 31 net sets.

2.1.7 South Pacific charter (October 1974)

The *South Pacific* was chartered for the purpose of conducting experiments utilizing a tapered appendage added to the top of the net at the apex of the backdown channel. This appendage was called a "porpoise

apron." The use of the apron had a substantial effect on the vertical profile of the net during backdown. A shelf-like ramp was formed which inhibited the fish from coming up underneath the porpoise (thereby driving them toward the seiner and away from the release area.) This is attributable to a primary design characteristic of the apron whereby the "load" of the net is more evenly distributed around the perimeter of the backdown channel during backdown. An apron extension (called a "chute"), fabricated of 1 1/4-inch meshes, was added to the top of the apron prior to making the last eight sets. This fine mesh demonstrated a capability of resisting entanglement. Even when the porpoise were observed to vigorously charge the net, they merely bounced off without becoming entangled.

2.1.8 J. M. Martinac charter (October 1974)

The *J. M. Martinac* was chartered for the purpose of conducting studies of a 1 1/4-inch mesh safety panel that extended around the entire backdown area. Observations were extremely encouraging in that porpoise were apparently unable to become entangled in the 1 1/4-inch meshes.

Certain problems were noted which involved the use of the fine mesh webbing. During backdown, the fine mesh panel on the outboard side of the net was displaced into the backdown channel by water pushing-against it. The larger mesh webbing (4 1/4") under the panel did not present as much water resistance and consequently did not move across

the backdown channel with the fine mesh. The water pressure caused the fine mesh panel to form a concave shape which extended into the backdown channel and reduced the amount of open surface area available to the porpoise. In addition, it allowed porpoise to move under two layers of fine mesh web when they sounded. It was also noted that the corkline was difficult to sink during backdown. This was attributed to the reduced quantity of water which could enter the net through the fine mesh webbing. An attempt was made to correct this problem. An extra bunch was pulled and thirty extra fathoms of web were left in the water during backdown; the stern end of the fine mesh panel thereby was moved away from the vessel allowing more water to enter the net. This reduced the severity of the problem, but did not eliminate it.

2.1.9 Porpoise "left-in" after completion of backdown

In mid-1975 an analysis of NMFS set log data revealed that 52 percent of all mortalities occurred as a result of porpoise being left in the net after the completion of backdown (no post-backdown rescue).

In other words, 52 percent of all porpoise killed were observed alive and not entangled when the backdown operation ceased and net hauling commenced. It is important to remember that the mesh size of the safety panel is of little consequence after the releasing of the bunchlines and net-hauling operations effectively remove the safety panel from the webbing surrounding the porpoise. This net-hauling operation leading to the sacking-up phase is characterized by a decrease in the area available to the porpoise, and an increase in their exposure to the more-hazardous, 4 1/4-inch webbing. Although some animals were rescued after the net was sacked up, a great number of these "left-in" porpoise were killed.

2.1.10. Modified large-volume seine (July 1975)

During early 1975 the experimental large-volume purse seine underwent major modification in an attempt to improve its practicality. An additional 100 fathoms in length was added to its mid-section. The net was tested in fishing to the west of the Commission Yellowfin Regulatory Area (CYRA). While at sea, the braided nylon ring bridles were replaced with conventional galvanized chain due to extensive damage from abrasion. Additionally, the 1/2-net zipper was removed in order to reduce a tendency for localized collapse near the mid-net bunt. Test results gave a porpoise mortality rate (per ton of tuna) of about double the fleet average and an approximate 30-percent increase in kill per set. The cruise was terminated prematurely due to a mass protest of

American vessels against foreign vessels allegedly fishing within the closed CYRA. Virtually all American vessels ceased fishing and returned to port during the protest action. No further set-log data have been collected relative to this seine.

2.1.11 Bold Contender charter (September 1975)

The record-low mortality rates demonstrated during the chartered cruise of the *Bold Contender* have precipitated a great deal of interest. The average number of porpoise killed per porpoise set was 3.9; the average kill per ton of yellowfin tuna landed was 0.22. (The 1975 fleet-wide averages for these indicators were 16 and 1.3, respectively.) The design of the so-called *Bold Contender* system included the following:

- (1) Speedboats were used to hold the net open as a preventative rather than a remedial measure.
- (2) Continuation of the backing-down operation until all live porpoise were out of the net.
- (3) The use of a double-depth and extended-length (180-fathom) porpoise safety panel constructed of 1 1/4-inch fine-mesh webbing.
- (4) A gently tapered 1 1/4-inch small-mesh porpoise "apron" to help better distribute the load of the net and reduce canopy formation.

- (5) A sharply tapered, 1 1/4-inch small-mesh "chute" to accelerate water flow over the corkline. Combined with the apron this chute accentuated the ramp-like profile of the backdown area, keeping the fish from coming up under the porpoise, while forming a deep pocket well forward of the porpoise for the containment of fish.
- (6) A small rubber raft was used to better observe the relative position of fish and porpoise during backdown, and to regulate backdown speed accordingly. The raft was also an effective platform for the hand release of any porpoise left in the net after backdown.

Tests involving the use of differential current indicators (double depth) and an improved set position compass were undertaken. Problems with erroneous indications of current direction were encountered when the scientific team deployed the devices from the seiner. They rarely gave a usable indication of current due to the formation of huge loops and swirls. Several attempts were made to increase the weight and buoyancy of the devices without satisfactory results. Because current indications were poor, the set position compass was not used. A "porpoise grabber" was also tested. Although a moderate degree of utility was noted when used on porpoise in the sack, use from an attending speedboat at the end of the backdown channel was generally unsuccessful.

The success of the cruise was attributed to the use of a complete system including speedboats to hold the net open, a radical change in net design, and the use of the small rubber raft. The raft was particularly useful in locating and releasing those "passive spotters" that had a tendency to "rest" on the bottom of the net. This "passive spotter" phenomenon was reported in the *Bold Contender* cruise report. The record-low mortality rates demonstrated during the cruise of the *Bold Contender* soon precipitated a joint government-industry mass test of the new gear.

2.1.12 The 1976 mass gear test

Twenty vessels took part in the test, 10 with the complete *Bold Contender* system, and 10 having only double-depth, fine-mesh safety panels. The major reason for designing the experiment in this manner was that questions had been raised as to whether the success of the *Bold Contender* system was attributable primarily to the structure of the apron-chute complex or primarily to the use of the 1 1/4-inch mesh webbing, hence the division of vessels to test both concepts. The vessels representing the *Bold Contender* system utilized the gear and methods previously described in Section 2.1.11. The vessels representing the fine-mesh sample utilized six strips of 1 1/4-inch mesh webbing in the backdown area. These were arranged so that the porpoise safety panel was three strips long (180 fathoms) and two strips deep (~12 fathoms). The vessels used in the sample were not randomly selected.

This was due to the voluntary nature of participation in the mass test and the desire to involve only those vessels which were operationally sound (no history of excessive mechanical malfunctions) in order to minimize the variance in kill rates and permit statistical comparisons to be made between the two types of gear. This has complicated efforts to statistically interpret the comparative effectiveness of the two gear systems relative to conventionally rigged vessels. An analysis was made utilizing all "normal sets" on porpoise by the vessels involved in the mass test. These sets were edited so as to exclude: 1) sets where gear malfunctions directly contributed to mortality, 2) sets that had a net collapse, and 3) sets where no porpoise were captured. The kill per set of the *Bold Contender* system sample was 4.5, while the fine-mesh sample killed 7.5 per set. While these ratios are not directly comparable, they do indicate a potential of the *Bold Contender* system to achieve a kill-per-set ratio considerably under the fleet-wide average of 14.1 for these "normal sets." It should also be noted that the incidence of zero-kill sets (when porpoise were captured) for the *Bold Contender* system sample was 56 percent, while with the fine-mesh sample it was 34 percent and with conventional gear it was 31 percent. The report on the mass gear test can be requested from the Director of the SWFC; the analysis of this experiment treats the data in much greater detail and as of this writing is in the final stages of preparation.

Although record-low mortality rates were achieved by many of the vessels using the *Bold Contender* system, some difficulties were identified by skippers and NMFS sea-going gear technicians. In particular, skippers

cited an inability to sink the corks at the end of the backdown channel during the later stages of backing down, requiring hand removal of several porpoise by rescuers in the rubber raft and speedboats. In addition, some skippers reported problems with the net sinking at the junction of the apron-chute complex. This was caused by an abrupt change in the taper between the apron and chute. In an attempt to alleviate both these problems, the design was modified so as to eliminate the change in rate of taper at the apron-chute junction. This modification of the *Bold Contender* system later became known as the "super-apron" configuration. The results of testing the super-apron will be discussed later (see 2.1.14).

2.1.13 Pre-backdown release (Da Rosa principal)

Another modification of considerable importance was made by Captain Chris Da Rosa aboard the seiner *Evelyn Da Rosa*. This modification involved the removal of most of the individual corks on the corkline for a distance of about 10 fathoms around the apex of the chute. In essence, the *Evelyn Da Rosa's* corkline at the chute apex had nine sections, each about one fathom long from which corks had been removed. Two corks remained in place between each section of bare corkline. This arrangement speeded up backdown operations and reduced the necessary amount of time spent hand releasing porpoise at the completion of the backdown operation.

Captain Da Rosa reported on another phenomenon which has very special significance. He noted that by directing the skiff to pull more from the stern during net hauling operations, he was able to cause the net to arrive at a configuration very close to that achieved during backdown; all this was managed prior to backdown. He reported that a combination of the skiff's pulling angle, and the removal of corks at the apex of the backdown channel often allowed many porpoise to escape prior to backdown. His rough estimate was that in approximately 50 percent of his sets, at least some porpoise escaped in this manner. In those sets where porpoise were observed escaping, the percentage of escapees prior to backdown averaged approximately 50 percent of those in the net. He noted further that in some sets 90 percent or more would escape in this manner, and in other sets 10 percent or less would escape. He reported that the size of the porpoise catch did not seem to influence either the percentage of sets where porpoise escaped or the percentage of porpoise escaping during a set. There was no apparent mad dash of porpoise once the escape route was found, rather a slow, steady trickle of porpoise would leave the net. It is significant that Captain Da Rosa made no attempts to affect the behavior of the porpoise so as to increase the incidence of escape. It is not unreasonable to expect that this phenomenon may be used to considerably more advantage in the future.

2.1.14 Elizabeth C.J. charter (October 1976)

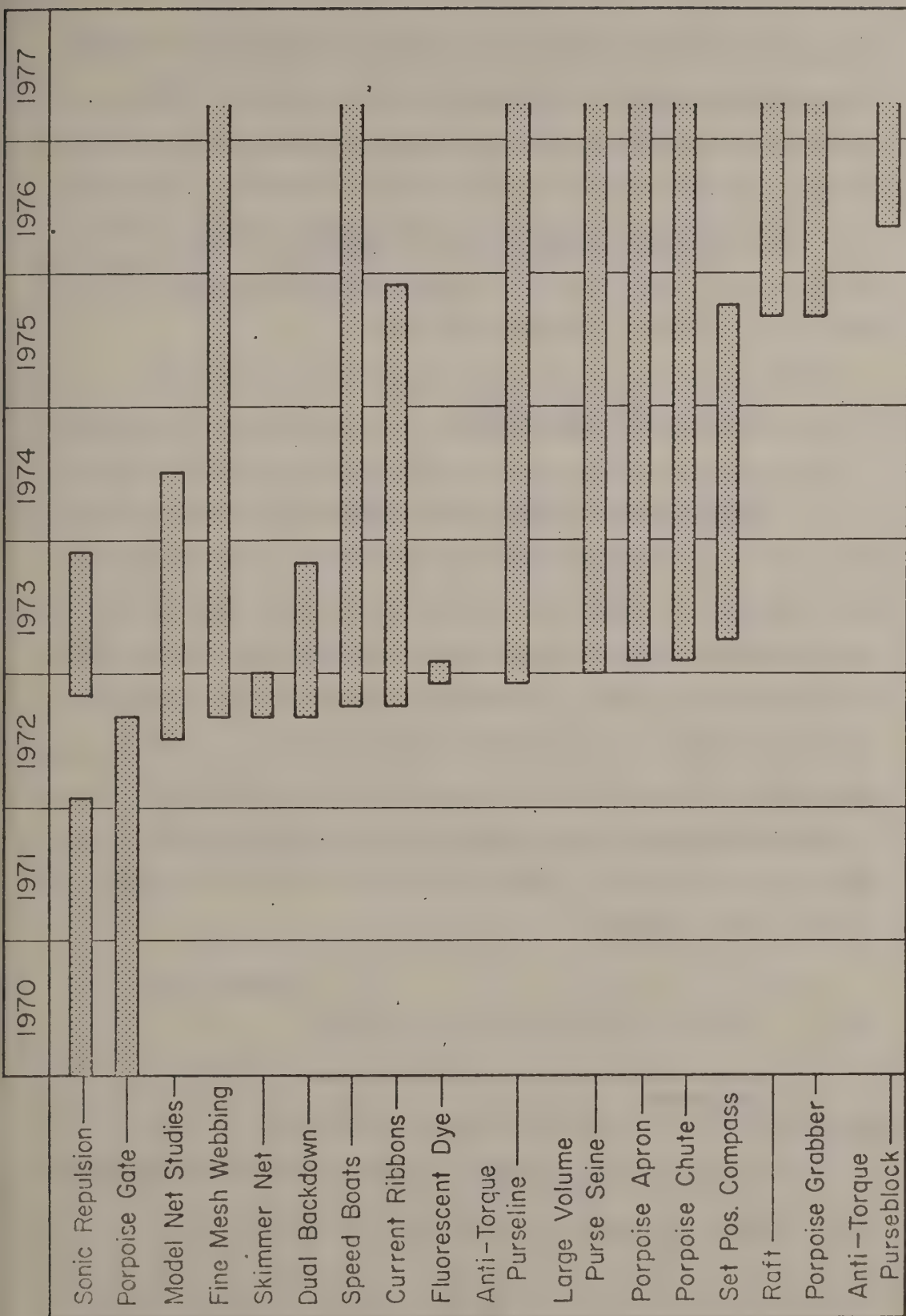
The *Elizabeth C.J.* was chartered for the twofold purpose of conducting gear-related and behavioral experiments (see Section 3.0).

Behavioral research objectives were identified during a tuna-porpoise behavior workshop sponsored by the Marine Mammal Commission in Santa Cruz, California (December 1976). Record-low mortality rates were achieved during the cruise. The average number of porpoise killed per porpoise set was 0.356; the average kill per ton of yellowfin tuna landed was 0.017.

During the cruise, observations were conducted from a raft in the backdown channel for 40 of the 45 sets that were made. The objectives of these observations were to more closely observe the dynamics of the super apron during backdown and to observe the behavior of porpoise and tuna in the net.

The raft was useful in herding the porpoise towards the release area. This seemed effective, but only if the raft stayed more than 10 m from the nearest animals. When some groups of porpoise (10-100) would refuse to go over the corkline during backdown the raft man would wait until they were congregated near the sunken corkline and then paddle directly at them making as much commotion as possible. The initial avoidance-response of the nearest animals often started them over the corkline and backdown would proceed until completion.

More-specific observations of the super apron were needed to determine whether the bifurcated characteristic of the *Bold Contender* system was reduced in the super-apron modification. Observations revealed that the apex of the backdown area was still shallow, and that by



applying reverse engine power during backdown the depth of the backdown channel could be controlled. When the tuna came to the shallowed, porpoise-filled backdown channel they would turn and swim back towards the boat. No great increase in loss of fish was observed. It was also noted that the formation of canopies in the backdown area was further reduced using the super-apron modification, and rarely was any entanglement seen in the 1 1/4-inch, fine-mesh safety panels.

2.1.15 Summary - NMFS gear research

During the past several years, a comprehensive research program aimed at the reduction of porpoise mortalities in the yellowfin tuna fishery has resulted in the development of greatly improved fishing gear and methods which are based upon observed behavioral characteristics of both porpoise and tuna. Configurations such as the *Bold Contender* system and the super apron have demonstrated a capability to greatly reduce the incidental killing of porpoises by purse seine vessels. It is reasonable to expect that porpoise mortality could be greatly reduced through the extensive implementation within the fleet of these improved fishing systems.

2.2 Porpoise Rescue Foundation, Gear Research

John DeBeer

The Porpoise Rescue Foundation (PRF) was formed in December 1975 to promote and support education, training, and activities

relating to the reduction of porpoise mortality and the serious injury of porpoise in the course of fishing operations. The activities of the PRF for fiscal year 1976 conveniently may be placed in five categories.

2.2.1 Cooperative program with NMFS Southwest Region (SWR) to place observers on vessels

The PRF assisted in placing observers on 54 trips during 1976, and assisted in the placement of 15 observers during early 1977 before the fleet virtually terminated all fishing activity in response to court rulings. The PRF also actively participated in the involved task of re-designing the data elements contained in the field-data logs (i.e., set-log, marine mammal sighting record, etc.) used by NMFS seagoing technicians. Also participating in this effort were the Marine Mammal Commission, Project Monitor (an environmental consortium), and both the NMFS Southwest Region and Southwest Fisheries Center. This task was undertaken in order to further articulate and increase the precision of the porpoise/tuna quantitative data base and to meet the data needs required by the 1977 regulations.

2.2.2 Gear research

The PRF provided 131 thousand dollars for gear research in fiscal year 1976. The majority of these expenditures were incurred purchasing webbing to outfit about half of those vessels involved in the mass gear

test (see Section 2.1.12). Experimentation with rescue rafts and cork-line floats was conducted on a number of boats. Extensive discussions also were carried out through the year with various inventors of new gear and mortality-reduction techniques.

2.2.3 Elizabeth C.J. charter

The PRF furnished a marine scientist for both the gear and behavior portions of the cruise. The program manager also spent a considerable amount of time helping to make arrangements and prepare for the cruise.

2.2.4 Captain's panel

The American Tunaboat Association (ATA) conducted tuna/porpoise workshops for skippers and other key vessel personnel between 1972-1975. At these meetings, ad hoc groups of the most experienced and successful skippers were formed and panel discussions were held in order to seek solutions to the porpoise problem. These panels were an effective means of exchanging knowledge among the participants. In 1976, NMFS took over the tuna-porpoise workshops by mandating attendance as a requirement for obtaining a Certificate of Inclusion under category II of the general permit (MMPA). (This category deals with the taking of marine mammals in association with yellowfin tuna using purse seine gear.)

Based on the favorable history of the tuna/porpoise workshops, PRF cooperated in forming a successor to the workshop, a group known as the "Captain's Panel." The panel was organized to serve principally as a peer review group to assist those skippers having problems with the release of porpoise. Additionally, it serves as a "sounding board" for new gear and operating techniques which may enhance porpoise rescue.

The panel is now a functioning group within the PRF. To date, two organizational and two operational meetings have been held. At the operational meetings, the panel reviewed all of the summary statistics for vessels that carried NMFS observers in 1976, and selected for an in-depth analysis the seven trips with the highest kill rates and/or highest total kills. Following these analyses, a series of confidential meetings on how to reduce mortality were held with the affected skippers and a sub-group of the panel. The causes of mortality were reviewed and recommendations were made on how to reduce it.

2.2.5 Cooperation with other organizations and agencies

The following is a partial list:

- (1) Stanford Research Institute
- (2) Y² Associates
- (3) Naval Ocean Systems Center

- (4) Hubbs/Sea World Research Institute
- (5) NMFS/National Fisheries Engineering Laboratory, Bay St.
Louis, Mississippi
- (6) Guillen Enterprises

2.3 Del Monte Corporation Gear Research

Chris Norgaard

Between November 1975 and January 1976, Del Monte Corporation conducted gear experiments on three of their fleet vessels. Each of these seiners was outfitted with an apron of 1 1/4-inch mesh webbing. These aprons measured 71 fathoms in length and 9 fathoms in depth. Each was attached above a 2-inch-mesh Medina panel with the apex of the apron located about 185 fathoms from the bow ortza (bunt end of the net). Two of the vessels in the test reported that the apron worked very well; the skippers indicated that the kill was minimal (15 killed of 7600 caught). The third and largest vessel in the test was plagued with severe mechanical failures and reported that no benefit was derived from the apron. The skipper cited the uncontrolled sinkage of the apron area as a particular problem. After completing these test cruises, the nets were further modified. Larger, more buoyant corks were used over the apron area to minimize the sinkage problem. These corks were of different colors, with yellow corks along the sides and dark-blue corks at the apex of the

backdown channel. This was done to determine whether color variation might enable the porpoise to find the optimal release area of the net, however results have been inconclusive. The vessels still are equipped with aprons.

Further testing involved the use of streamers on the net. These streamers were made by unraveling yellow polypropylene rope, and were tied to the 4 1/4-inch mesh portions of the net. Polypropylene is more sound-reflective than nylon, and the hope was that the porpoise could more accurately sense the relative position of the webbing surrounding them. Results of this testing also proved to be inconclusive.

Editor's Note: Del Monte has recently sold its tuna fishery assets, but has offered to continue to cooperate in reducing porpoise mortality by providing the expertise of their marine engineer, Chris Norgaard.

2.4 Progressive Fishing Enterprises; The Use of Vinyl Panels in the Backdown Area

John Gonsalves and Dan Greenblat

The purpose of this study was to test the operating characteristics of impenetrable panels for purse seine nets (MMC contract #MM6A0007)

patented by John T. Gonsalves (Gonsalves, No. 3,849,927; Nov. 26, 1974). This contract report will be available from the Marine Mammal Commission in mid-summer 1977.

2.4.1 Design

The test apparatus ("demonstration device") consists of: 1) a tow boat, 2) a spreader frame, 3) a truncated purse seine net, and 4) the Gonsalves panels. The apparatus accurately simulates the net during backdown. When towed with various panel combinations attached to the apex of the net, such things as corkline submergence, ramp formation, and resurfacing times can be observed.

2.4.2 Major conclusions

- (1) Panels significantly reduce net tendency to form bends.
- (2) Panels can be used to form larger backdown areas.
- (3) Panels demonstrated consistent corkline submergence.
- (4) Panels prevent entanglement, reduce entrapment potential and produce a safer net environment for porpoise.

- (1) Panels be resewn to 1 1/4-inch mesh webbing.
- (2) Ocean testing of apparatus is essential.
- (3) Underwater observations of ramp formation should be conducted.
- (4) Use of panels with Ethafoam rounds on the corkline at the apex be tested to observe increased stabilization potential.
- (5) Gonsalves panels be viewed as compatible and complimentary with fine-mesh panels (the former prevent entanglement while the latter retard entanglement).

3.0 BEHAVIORAL RESEARCH, 1976

3.1 Behavioral Studies, *Elizabeth C.J.* Charter

Ken Norris, Warren Stuntz

This work was supported by MMC contract MM6AC022. The final report will be available from the Marine Mammal Commission in the fall of 1977.

The objective of the behavioral observations conducted aboard the chartered cruise of the *Elizabeth C.J.* in 1976 was to prepare an ethogram on the porpoise schools involved with the yellowfin purse seine fishery. Initially, ethograms were to be developed for porpoise schools before, during, and after having been "set on" by a seiner. Due to problems with radio tags and radio tag monitoring equipment, observations of behavior after a set were minimal and definitive data on regrouping of schools, for example, were not obtained. During the set itself, many behavioral phenomena were observed.

The technological aspects of the fishing gear modifications were observed to be highly successful in terms of minimizing both porpoise kill and serious injury. The 21 sets observed by the entire behavioral team resulted in 12 porpoise killed. Underwater observations by SCUBA-equipped divers revealed that porpoise would almost always

simply bounce off the wall of taut 1 1/4-inch mesh that surrounds the backdown apex. The "super apron" worked beautifully, but its effectiveness in reducing mortality would probably vary depending on the level of expertise attained by various skippers and crews.

Porpoise were observed to have predictable responses to certain stimuli found in the set environment. For example, the wake of the seiner consists of a virtual wall of bubbles that the porpoise rarely would cross. The diminishing circle described by the seiner's wake thereby acts as an effective herding mechanism. Porpoise responded to the "barrier" at distances of 100-200 meters. It was observed that, when once encircled, the porpoise positioned themselves within the net so as to avoid close proximity with the net wall. Within the net, the tuna usually were deeper than was the porpoise school.

While in the net, the porpoise were relatively easy to "herd." Both divers and the rescue raft acted as effective stimuli in this regard. The porpoise may be directed away from hazardous areas of the net by utilizing this response.

Finally a definite social structure or "pecking order" within the various schools was seen. The order runs both across and within species. The spotters, *Stenella attenuata*, were dominant to the spinners, *Stenella longirostris*. Spinners were observed to position themselves

around the edges of the spotter component of the school. Dominance within subgroups and between individuals was manifested by tail-swatting and biting. On one occasion a spotter charged a diver in an unusual display of hostility.

Prior to backdown the porpoise formed a horizontally tiered configuration. That is, there were aggregates of the school concentrated in layers, at descending depths down to about 60 feet. It was interesting to note that the smaller of the yellowfin tuna were often observed with the spinners rather than the spotters.

As crowding within the net increased during the net rolling process, the spotters would tend to assume a vertical position. If the crowding continued, some of the spotters would sink to the bottom of the net in apparent frustration. The spinners always remained horizontal and more active than the spotters.

3.2 A Trainer's Perceptions - *Elizabeth C.J. Charter*

Karen Pryor

In discussion with the other scientists it became apparent that my long experience with spotter porpoise in captivity allowed me to see and to interpret quite a good deal that was not obvious to the

others. For example, I can tell males from females at a glance underwater (adults anyway). Once I pointed out how to do this, everyone else could do it too; it was unfortunate that I hadn't been there 15 sets earlier, as it made underwater behavior much more understandable. I was also able to settle some arguments like "how come the porpoise don't look tired after a chase and set?" They do, they look really pooped, but in order to perceive this you have to know what a porpoise does when it's winded that it doesn't do otherwise. I was also very impressed with the calmness of the animals in the sets. Certainly they were under some stress, but they were exhibiting very normal behavior as far as I could see. They were, in fact, waiting. They had been here before.

Being familiar with learned behavior I was able to pick out seven examples of widespread learning in the schools.

- (1) The second school tried to avoid being chased by "hiding" under the surface of the water and staying motionless. Most unusual behavior, and the captains tell me it often works. I saw this from the bridge, while the animals were about a mile away still, and got very excited about it, "They're trying to hide!" and the captain confirmed that in his opinion they certainly were.
- (2) The second school made concerted efforts to get across the *C.J.*'s bow to the starboard side. One group succeeded,

and once they were well clear of the ship, began the conspicuous "free-running" or "running-away" behavior. To me this suggests that they knew they were free when they got to starboard. This implies considerable previous experience.

- (3) While the first school showed avoidance of the ship's wake, the second school was bolder, and one group (100 plus animals) dove under the wake and escaped that way.
- (4) In the second set, the porpoises rafted in the null zone--as far from the ship as possible without getting close to the net--until pursing had ceased. They then moved immediately to the backdown area, before backdown began, although this put them much closer to the net and somewhat closer to the ship.
- (5) These animals displayed no agitation--still waiting--until 10 minutes had passed without backdown beginning. Just as I began to worry that this was taking a long time (the purse rings and webbing were snarled) the porpoises "began to worry" with bunching, chuffing (fear-breathing) and aerial behavior becoming evident. They then moved back to the null zone.

(6) The "ordinariness" of behavior in the net was a prime example of previous experience.

(7) A final clue was the captain's behavior, not the porpoises; he kept his speedboats hidden behind C.J. throughout the chase, knowing from experience that these "untouchables" could not be herded with speedboats and would be difficult to handle if flushed prematurely by the pongos.

I might mention here two other practical questions which came to mind. There had been an attempt to tag porpoises with streamer tags stuck into the dorsal musculature. These tags were not seen again, and Dave Holts told me he saw one porpoise with a small wound in the tagging area, but no tag. Spotters are not very manipulative (tags like this wouldn't last 10 minutes in, say, *Steno.*, they would pull them off each other at once) but I did see a spotter mother try to knock a remora off her baby, five times, and I think it's likely that even spotters will try to pull tags off each other. I think tagging is very valuable, but I will suggest that future tags, whether of streamers or not, be put through the dorsal fin with a washer arrangement on each side, so they cannot be pulled out by another porpoise. (I have tagged domestic porpoises in this manner. It is easy to do and seems to cause little pain.)

Secondly, if the same schools are being set on again and again, what does that mean to the counting of numbers of schools and animals sighted on a given trip?

3.3 Acoustical Conditions in Tuna Purse Seining, *Elizabeth C.J.* Charter

F.T. Awbrey, W.E. Evans, J.S. Leatherwood, and D.K. Ljungblad

Sounds produced during all stages of purse seining for yellowfin tuna were recorded during one waterhaul set and nine porpoise sets by the M/V *Elizabeth C.J.* between October 16 and November 2, 1976. The recordings were made to establish a data base for possible future studies on the role of sound in porpoise mortality.

Speedboats from the *Elizabeth C.J.* produce noise which is mostly concentrated below 6 kHz, with a peak at about 2 kHz. Spectrum levels (sound energy in a 1 Hz bandwidth, 1 m from the source) ranged between 100 and 105 dB re 1 μ Pa. At typical chase distances, overall sound pressure levels (SPL) from speedboats reach about 120 to 125 dB re 1 μ Pa.

Sound energy from the *Elizabeth C.J.* falls mostly below 5 kHz and has a pronounced peak at 360 Hz. Spectrum levels during the chase and during backdowns may reach 120 to 125 dB re 1 μ Pa with overall SPL of 120 to 130 dB re 1 μ Pa at typical chase distances. Porpoises in the net are exposed to ship produced noise of 110 to 120 dB SPL re 1 μ Pa at typical chase distances. Porpoises in the net are exposed to ship produced noise of 110 to 120 dB SPL re 1 μ Pa, concentrated mostly below 2 kHz.

Porpoise whistles within the net may fall as much as 15 to 20 dB below occasional very-loud noises such as bow thrusters or speedboats keeping nets open. Even such loud noises appear to have little if any affect on intensity or character of porpoise vocalizations. Most of the porpoises' sounds range between 6 and 20 kHz where there is very little energy from boats. Noise produced by the M/V *Elizabeth C.J.* apparently does not seriously interfere with the porpoises' vocal communication signals.

3.4 Reactions of Yellowfin Tuna to Prey Scents

John Bardach (University of Hawaii/Hawaii Institute of Marine Biology)

Reactions of yellowfin tuna to prey scents in the form of rinses and extracts of prey were investigated. Fish were held in a 7.5-m diameter x 1-m deep, flow-through tanks (swimming pools) into which sensory clues of a chemical nature could be introduced without other sensory inputs. The work was done at the Kewalo Laboratory of the National Marine Fisheries Service in Hawaii. Responses were videotaped and analyzed for time-motion and other aspects of change from normal swimming in captivity.

Rinses of nehu (*Stolephorus purpureus*), anchovy (*Engraulis mordax*), surf smelt (*Hypomesus pretiosus*), squid (*Loligo*, sp.), akule (*Trachurus crumenophthalmus*) and opelu (*Decapterus pinnulatus*) were tested, as were bottlenosed dolphin (*Tursiops*, sp.) feces. The latter

elicited no response while among the rinses of the former species dilutions of 1 part per trillion parts of water (200 cc of filtered rinse in about 30 M³

of flowing sea water were effective. Rinses of several species brought forth strong feeding responses. These manifested themselves in accelerated swimming, change in swimming patterns, circling, attempts at localization of the moving stimulus cloud, as well as the appearance of feeding bars, in some cases.

Chemical analyses of the stimuli revealed that 1) only the non-volatile fraction of the complex chemical mixture was very effective, 2) both the amino acids and amino compound fraction, as well as the non-amino fraction were also effective with the latter eliciting much lower and the former perceptibly lower reaction levels than the whole extract. The operation of a complex, fingerprint-type stimulus is thereby suggested, 3) plugging of nares of some yellowfin tuna in the captive population established that the responses were, indeed, olfactory ones and not elicited through taste.

The amino acid composition of prey rinses was ascertained through resin exchange column filtration and thin layer chromatography. The major amino compound in nehu rinse was tryptophane but in surf smelt it was tyrosine. The former was effective in a dilution of between 10⁻¹¹ and 10⁻¹³ M; other amino acids were present in the mixture in even lesser amounts.

4.0 OTHER NMFS RESEARCH 1976

4.1 National Marine Fisheries Service/Southwest Region/Observer Program

Serge Birk

The tuna/porpoise observer program transferred from the NMFS Southwest Fisheries Center (SWFC) in La Jolla, California, to the NMFS Southwest Regional (SWR) office in June 1975. The SWR office is located in Terminal Island, California. In an effort to maintain better contact with the fleet a field office was established at the "B" Street Pier, 1140 N., Harbor Drive, Room 7, San Diego, California 92101.

The tasks of the "B" Street field office are as follows:

- To gather scientific and management data utilizing trained observers aboard tuna purse seiners.
- To provide to the fishermen the training required as a condition for the issuance of Certificates of Inclusion.
- To inspect gear and equipment aboard tuna purse seiners as required by marine mammal regulations.

Observers are recruited from the U.S. Civil Service Commission's GS-05 Biological Technician register which refers candidates with academic

backgrounds in biology, including emphasis in fisheries and marine science disciplines. A 3-week intensive observer training session covers the areas of purse seine technology, marine mammal regulations, marine mammal identification and sea going data collection procedures.

The data and specimens collected by the observers are utilized by researchers in such areas as gear research and mortality reduction technology, biological research, and stock assessment activities. Approximately 10 percent of the tuna fleet's vessel trips were monitored in 1976. Thirteen of the 54 cruises occurred to the west of the Commission Yellowfin Regulatory Area (CYRA). The tentative goal for 1977 was to monitor 25 percent of the fleets' fishing effort (i.e., each U.S. vessel would carry an observer for one trip in the year). However, since the fleet has spent a considerable part of the year in port, and since 130 more observer trips are planned, nearly 40-50 percent of the 1977 trips will be observed.

4.2 Fleetwide Mortality Estimation

Nancy Lo

Porpoise mortality associated with the U.S. tuna purse seine fishery is estimated utilizing kill data returned by NMFS sea-going observers (Fisheries Biological Technicians). Observers are placed on

vessels that are randomly selected from within the fleet. A stratified sampling scheme is used in projecting the fleetwide kill. The vessel-trips are stratified according to:

- Gear type

Gear type includes 1) conventional purse seine and 2) fine mesh systems and or *Bold Contender*/super-apron systems.

- Trip type

There are three trip types, a round-1 trip is generally the first trip of the year for the selected vessel. These trips are generally associated with considerable fishing on porpoise. A round-2 trip generally is the second trip of the year and usually begins within 30 days of closure of the CYRA to unregulated yellowfin tuna fishing; they are less heavily dependent on fishing on porpoise. A round-3 trip usually occurs during the last half of the year. These are regulated trips which fish by and large outside the CYRA and are heavily dependent on porpoise fishing. Round-3 trips may fish inside the CYRA under IATTC regulations on certain allowable percentages of yellowfin in their catch based on vessel size (e.g., small vessels such as some in NMFS Class I can catch as much as 60 percent yellowfin whereas all Class II and III vessels are limited to 15 percent yellowfin).

● Vessel class

Vessel class is determined by year of construction and carrying capacity tonnages.

Class I, <400 tons

Class II, >400 tons, <1961

Class III, >400 tons, >1960

During 1976 the mortality level was estimated on a monthly basis. At the end of a given month, the accumulated mortality estimate was developed from the start of the year through that month and the date when the quota would be reached was projected (Everett, and Lo, "The incidental kill of porpoise during the first half of 1976, the date of reaching the quota and the methodology utilized in each estimation").

In 1977 the total mortality will be estimated on a weekly, rather than a monthly basis. A vessel/trip data base is being developed at this time calculations of estimated mortality will be accomplished through the use of an automated information system (methodology to be published in the *Federal Register* in the near future).

4.3 Biological Research

William F. Perrin

There are currently five people at the SWFC engaged in biological research pertaining to the impacted porpoise stocks. These include three

biological technicians, one junior biologist, and myself. The current most-pressing biological research problems are 1) definition of stocks, 2) life history profiles by stock and 3) monitoring the structure of the kill.

In the task of defining the stocks, there are two major problems being worked on. One involves identifying areas and defining the nature of the boundaries between the eastern and whitebelly stocks of the spinner porpoise (*Stenella longirostris*). The data on hand suggests that these two forms are differentially distributed. Another problem involves determining the possible existence of relatively unfished stocks of spotter (*Stenella attenuata*) and spinner porpoise called the Southwestern forms. These stocks are located south of the equator and west of the Galápagos. Preliminary indications suggest that these southwestern forms may be morphologically distinct from the more heavily impacted stocks to the east and north.

Another priority task involves defining life history profiles by stock. Parameters estimated include: 1) length of gestation, 2) length at birth, 3) growth rates, 4) age and size at sexual maturity, 5) average age of adults, 6) pregnancy rates and 7) length of lactation period. At this time we have developed fairly good life history data for the spotter porpoise and the eastern form of the spinner porpoise. Now we are concentrating on the whitebelly form of the spinner porpoise, the streaker (*Stenella coeruleoalba*) and the whitebelly porpoise (*Delphinus*, sp.) A

basic problem with the life history work is age determination. This has been done by counting layers in the hard parts such as the teeth. However, we have had the problem of calibrating these layers; we aren't entirely certain of the ring/year rates. We think that there is one layer per year. A contractor is presently trying to adapt a method of age determination by looking at racemization of amino acids in the lenses of the eye. This technique has been successful with humans, and we are optimistic about having some useful data on this shortly.

Our third task is to monitor the structure of the kill. The objective is to detect changes in the population structures through analysis of our samples collected through the years. Such things as the pregnancy rate and length of the lactation period may change. However, we don't know how representative our samples are. We may have an opportunity to look at entire schools using the dedicated vessel. Subsequently, the kill samples could be compared to whole schools to get an idea of their representativeness. Another contractor is sectioning the backlog of *Stenella* teeth collected since about 1973. Hopefully this will let us examine the age structure of older animals killed through the years. This may reveal a change in the age structure of the kill.

We rely very heavily on the specimens and life history field data returned by the sea-going observers.

Joseph Powers

Before permits may be issued for the taking of species or stocks which are impacted by incidental purse seine mortality in the eastern tropical Pacific, the National Marine Fisheries Service is required by the Marine Mammal Protection Act (MMPA) and by recent court interpretations of that Act to determine the levels of optimum sustainable population (OSP) for each of the impacted species or stocks. In order to comply with this mandate, NMFS held a workshop of scientists to determine both the criterion for determining OSP and whether in fact the affected stocks were below OSP (SWFC Administrative Report No. LJ-76-29). "Optimum sustainable population is a population size which falls within a range from the population level of a given species or stock which is the largest supportable within the ecosystem to the population level that results in maximum net productivity. Maximum net productivity is the greatest net annual increment in population numbers or biomass resulting from additions to the population due to reproduction and growth less losses due to natural mortality." The stock assessment workshop participants believed that the term maximum productivity should be interpreted as maximum net productivity. Maximum net productivity was interpreted and defined as being the lower limit of the range of OSP. The workshop participants believed that any porpoise stock whose abundance is less than 50 percent of the

unexploited level probably is below MNP, whereas any stock much more than 70 percent probably is above MNP. Therefore the lower limit of OSP was chosen to be the lower bound of the range of possible MNP values. Subsequent to the workshop, however, several participants felt that a more definitive statement must be made and expressed the opinion that 60 percent is a prudent approximation. In any event, additional scientific information is necessary to firm up this estimate.

The ratios of the present levels of the affected populations to the initial levels were calculated and compared to the OSP criterion. Data used for these calculations were a 1974 aerial survey, observer data from 1974-1976, IATTC records back to 1959, NMFS determined incidental mortality and reproduction rates, and natural mortality rates estimated for similar porpoise stocks. Due to the uncertainties associated with some of these estimates, several alternatives were used to determine the effect of these uncertainties on the outcome.

The offshore spotted dolphin, using the best estimates for population size and vital rates, was found to be greater than 60 percent of the initial (1959) levels as of January 1, 1977. Using the most conservative estimates the spotted dolphin population level dropped below 50 percent, but has now increased above 50 percent.

The eastern spinner dolphin was determined to be at least 54 percent of initial levels using the midpoint estimates. Using the more conservative estimates, the percentage is below 50 percent. For these reasons, the eastern spinner dolphin was dealt with more stringently in the 1977 regulations.

The whitebelly spinner was determined to be above the lower ranges of OSP, primarily because it has been exploited for a relatively short period of time (since 1969).

The other species/stocks were either determined to be above the lower ranges of OSP due to the insignificant amount of incidental mortality or were not included in the 1977 allowed take due to an inability to make population assessments.

The porpoise stock assessment task has undertaken to improve and expand upon these OSP estimates. The present annual budget is \$525,000 and includes four senior-level scientists and several support personnel.

The largest proportion of this year's budget is allocated to a comprehensive aerial-shipboard survey designed to obtain better data for population estimates. These estimates should reflect an improvement over past efforts, both in terms of their precision and accuracy. They also will provide a new base point for comparing trends in population levels.

The survey analysis will be based upon line-transect theory to determine the density of schools. Photographic techniques are employed with the aerial survey to improve school-size estimates.

Other expenditures are for tagging studies designed to determine movement of the porpoise. This includes short-term aggregation breakdowns caused by net sets and more-long-term migrations of the porpoise within the geographical range. Tagging may also provide supplemental data for the population estimations.

Present tagging work is centered on developing tags which are specific to small cetaceans. These investigations include improvement of standard tags to meet the specific requirements of porpoise tagging and some work with the Bay St. Louis, National Fisheries Engineering Laboratory in development of a prototype design for disc and spaghetti tags. Work has

also begun with Bay St. Louis to develop a radio pack for porpoise to be tracked by satellite. This can be coupled with environmental data to more completely define the geographic distribution at any one time.

Recent research cruises have also investigated the problem of visual estimates of school size taken from shipboard and from the air. These will be used to better understand the relationship of estimates taken by the two methods.

Using results from the above research activities, we hope to improve our stock assessment estimates and estimates of the level of OSP in order to meet the mandate of the MMPA.

4.5 Preliminary Report, O.S.S. *Surveyor*, 1976*

David Au

The main purposes of the study conducted aboard the *Surveyor* were 1) to study the behavior of porpoise schools relative to an approaching ship and 2) to determine the consequences of this behavior as it affects detecting and estimating the size of porpoise schools. These studies were carried out using both a shipboard observer team and a helicopter observer team. Porpoise behavior was recorded both by still and motion picture photography. Field notes, yet to be compared with careful inspections of photographs and relative distance plots, suggest that porpoise schools often detect the ship at a distance of between 2 and 3.5 nautical miles. The school will set a course of escape during the closing interval; usually there is no deviation from this course until the ship is within a distance of 1 mile. The predominant

school configuration observed was that of numerous loosely scattered groups of two-to-six animals each. When alarmed, these groups would aggregate more tightly. Little or no evidence of "stacking" was detected, where layers of animals, one upon the other, are swimming together.

*(This report was not presented during the workshop.)

5.0 IDENTIFICATION OF RESEARCH PLANS, 1977

This section outlines planned areas of research by NMFS and PRF during 1977. (A summary of the presentation made by Harold Spuhler concerning the emphasis and organizational structure of the National Science Foundation is located in Appendix IV.)

5.1 NMFS Research Plans, 1977

The National Marine Fisheries Service plans for 1977 are as follows. Due to the uncertainty of the porpoise-tuna issue, however, significant departure from these plans may occur.

5.1.1 Porpoise stock assessment

Budget: Six permanent and 0-10 temporary positions; \$525,000

- (1) Field a major aerial survey to estimate porpoise densities and abundance in the eastern tropical Pacific (refer to Section 4.4).
- (2) Field a porpoise distribution cruise with the *David Starr Jordan* and *Townsend Cromwell* to delimit certain stock boundaries and to cover areas not accessible to the aerial survey.
- (3) Revise stock boundaries according to cruise results and significant correlates with environmental conditions.

- (4) Revise estimates of porpoise stock sizes based upon the above information and data obtained from NMFS field technicians aboard commercial tuna vessels.
- (5) Update total mortality estimates (both natural and incidental) using age distributional data from NMFS observers and comparable published rates.
- (6) Coordinate research programs aimed at the development of a small cetacean tag.
- (7) Supervise contract for the experimental design of a mark and recapture program.
- (8) Cooperate with the National Fisheries Engineering Laboratory (NSTL) in an effort to enable satellite tracking of radio-tagged porpoises.

5.1.2 Porpoise mortality reduction technology

Budget: Three permanent and one-to-three temporary positions;
\$304,000.

- (1) Introduce proven fishing gear and techniques into practice in the domestic tuna purse seine fleet to effect reductions in incidental porpoise mortality.
- (2) Continued monitoring and refining of previously developed porpoise-saving devices and techniques.

- (3) Continued evaluation of: porpoise super apron, modified Medina panels, speedboats (to prevent net collapse), NMFS experimental large-volume purse seine and porpoise grabbers.
- (4) Review and evaluate suggestions submitted by interested persons regarding modified fishing gear and/or techniques for saving porpoise (e.g. Guillen snap links and Da Rosa phenomenon).
- (5) Conduct field trials of possibly effective sonic and chemical devices and techniques for separating porpoise from tuna before or during encircling with purse seine.
- (6) Continued development and performance evaluation of experimental purse-block suspension system and torque balanced cable to reduce incidence of rollups.

5.1.3 Porpoise biological studies

Budget: Five permanent and one-to-three temporary positions;
\$143,000.

- (1) Complete processing and analysis of 1976 observer life history data and specimens.
- (2) Process 1977 observer specimens and data.

- (3) Complete analysis of growth and reproduction of white-belly spinner.
- (4) Complete manuscript on the biological parameters of the whitebelly spinner.
- (5) Complete analysis of life history data for striped dolphin.
- (6) Complete manuscript on the biological parameters of striped dolphin.
- (7) Complete summary and review of tagging through 1976.
- (8) Continue collaborative work on revision of *Stenella* and definition of stocks.
- (9) Supervise contract to section the backlog of *Stenella* teeth in order to obtain more complete data on the age structure of the kill.
- (10) Supervise contract to process life history specimens and data for common dolphin.
- (11) Monitor changes in biological parameters of exploited porpoise stocks for input into stock assessment models and thence into quota determination.

- (12) Train observers and fishermen in stock identification.
- (13) Process incoming biological specimens for use in life history analyses.
- (14) Supervise contract to determine porpoise age through racemization of amino acids in eye lenses.

5.1.4 Quantitative analysis and data management

Budget: Eight permanent and two-to-three temporary positions;
\$195,000.

DATA MANAGEMENT

- (1) Design data collection forms and observer field manual.
- (2) Complete the documentation of elements within the data collection forms and train observers in accurate data collection methods while at sea.
- (3) Develop computer programs to create data bases for observer data.
- (4) Develop computer programs to machine-edit observer data.
- (5) Manually edit incoming observer data and prepare for key punch.

- (6) Key punch, machine-edit, manually review, and place data on appropriate data bases.
- (7) Maintain and modify existing computer programs to analyze, summarize and report on observer data.
- (8) Develop new computer programs to analyze, summarize and report on observer data.
- (9) Develop documentation of historical data formats and data. Prepare historical data for both manual and machine editing and subsequent placement on appropriate data bases.
- (10) Provide programming assistance and expertise to staff researchers.

QUANTITATIVE ANALYSIS

- (1) Design methodology for estimating the incidental porpoise kill by the U.S. tuna fleet.
- (2) Design methodology and sampling scheme to collect data for determination of kill rates.

- (3) Monitor porpoise kill by the U. S. fleet in terms of levels, rates, quotas, and performance in reducing mortalities.
- (4) Provide statistical expertise to Program scientists to assist in experimental design and analysis.
- (5) Evaluate effectiveness of regulations.
- (6) Estimate number and kinds of porpoise killed by the non-U. S. fleet.

In addition to the above budget, a planned increase in the observer program in 1977 will mean an additional four permanent and four temporary positions, and \$180,000 for the SWFC in order to process the increased data flow.

The NMFS Southwest Regional Office is planning for over-130 observer trips in 1977. The budget for the observer program for 1977 is expected to be about \$1,200,000.

5.2 PRF Plans for 1977

The Porpoise Rescue Foundation plans to continue in the joint effort of developing and encouraging the implementation of improved fishing methods and techniques. Four "permanent" people and one consultant will be involved in varying degrees with this effort. In addition

to the \$321,000 budgeted in the following sections, an additional \$30,000 has been placed in a contingency fund. Plans for 1977 may be divided into three tasks.

5.2.1 Placement of observers

Budget: \$23,787

Continued cooperation with NMFS in placement of observers during 1977.

5.2.2 Mortality reduction

Budget: \$257,982

- (1) Gear research - experimentation with the fine-mesh Medina panel, *Bold Contender* systems and super aprons. Near-shore experimentation and training with advanced gear.
- (2) Extension work with the fleet on a boat-by-boat basis. Introducing the latest gear and techniques. Monitoring types of fine-mesh systems installed in each vessel. Extensive interviews with the skippers.
- (3) Gear workshops.

(4) Training film.

(5) Operator's manual.

5.2.3 Captain's panel

Budget: \$39,231

(1) Preparation of statistics and trip-by-trip analysis for use relative to the Expert Skipper's Panel.

(2) Participation during "expert skipper" interviews of skippers with high-mortality performance records.

6.0 IDENTIFICATION OF DEFICITS IN THE 1977

RESEARCH PLANS

After the presentation of research plans for 1977, the forum was opened for criticism of these plans. Deficits in proposed research, and priority planning (areas to be either augmented or reduced) were discussed. The following criticism of 1977 proposed research is separated into four categories: 1) impact assessment deficits, 2) mortality assessment deficits, 3) mortality reduction deficits, and 4) other deficits.

6.1 Impact Assessment Deficits

6.1.1 Assessment of variables and validation of assumptions related to school size and density estimates.

It was suggested that a sonar analysis of the depth structure of porpoise schools might be useful. This could provide a better understanding of the ratio of porpoise within a school that are on the surface and visible at any one time and thereby improve the precision of size estimations. However, evidence indicates that schools will be difficult to approach and that they will flee from the sonar pulses.

6.1.2 Alternative methods of estimating population levels

Changes of the age-sex structure within a population could provide meaningful stock assessment information. It was mentioned that known

changes in the ratio of males to females have been used to facilitate regressive estimations of population levels (specifically with deer). However, the available sex-structure data is based on kill samples and it has not been determined that the structure of the kill is representative of the structure of whole schools.

6.1.3 Characterization of age-sex, reproduction and survival parameters for each stock.

It should be determined whether the biological parameters for the various stocks differ significantly. While the parameters of the eastern spinner and spotter porpoise are reasonably well known, more effort should be directed at developing these data for the other impacted stocks. (Editor's note: see NMFS plans for 1977, Section 5.1.3 and NMFS Biological Research, Section 4.3.)

6.1.4 Population distribution (range) by season

Increased effort is needed to better determine the movements and areas occupied by the various stocks. An understanding of the extent to which these stocks overlap is necessary in order to accurately estimate population levels.

Satellite-linked tracking transmitters attached to porpoise (radio-tags) may be the solution to this problem.

Some skepticism was expressed regarding the current aerial survey. Weather conditions, sea states, human error and porpoise diving intervals could result in missing porpoise on the track line. Line-transect estimations rest on the assumption that everything on the track line is recorded. It was suggested that the use of a blue/green laser-activated camera may permit the detection of sightings that might otherwise be missed (refer to New Proposals Section, G. Gilmour).

6.2 Mortality Assessment Deficits

6.2.1 Is the kill representative of the population?

The biological parameters defined for each of the stocks are based upon the structure of the kill. A method for determining the representativeness of the kill is necessary. The dedicated vessel could provide a means for examining the structure of whole schools. In order to assess the representativeness of the structure of the kill, comparative data of this sort are necessary.

6.2.2 What is the magnitude of the foreign kill?

There have been no useful observed trips aboard foreign tuna seiners. Observed trips on foreign vessels could provide more reliable base line data for estimating the foreign kill.

6.2.3 Is the sampling program sufficient to give a reliable estimate of the kill?

Factors such as the representativeness of observed trips and the ratio of observed to non-observed trips need to be examined.

6.3 Mortality Reduction Deficits

6.3.1 Refinement of the super apron

Following the installation of the super apron, each vessel should conduct local dynamic tests. Problems with the installation, if any, could be detected and the super apron could be "fine tuned" by adjusting such things as the rate at which the webbing is "hung-in" to the corkline.

6.3.2 Training in use of gear and procedures

Demonstrations, films and manuals should be provided for this purpose. Extension workshops, interviews on the docks, and the Captain's

Panel could be used to make these training aids available. (Editor's note: these suggestions are already included in NMFS's and PRF's plans for 1977; see Sections 5.1.2, 5.2.2 and 5.2.3.)

6.3.3 Pre-backdown release

A closer examination of the Da Rosa effect is needed to better determine the degree to which it makes pre-backdown release possible. It was suggested that the use of snap-link pursing rings might enhance the Da Rosa effect. This gear combination should also be evaluated.

If an escape area is provided prior to backdown, the herding of animals within the net might increase pre-backdown release. Further work is needed to test the various herding techniques and devices; proposals include conspecific sound playbacks, pingers, rafts, bubble curtains, sonic barriers, and the huki-lau.

6.3.4 Alternative fishing systems

A non-encirclement system of fishing where porpoise aren't put in the net might be developed if more was known of the porpoise/tuna bond. It is possible that the elements of the bond could be duplicated, and the bond could be broken by the introduction of a super stimulus. This could enable separation of porpoise and tuna before the set. If the

porpoise aren't encircled the kill would be virtually eliminated. However, for this to be effective, the end result of catching the tuna must be achieved. That is, in addition to separating the porpoise from the tuna, it must be possible to direct the movement of the tuna to the extent necessary for making a successful set.

Another alternative system may be developed if it is determined that the tuna are attracted to the porpoise via stimuli that can be reproduced. A reproduction of this stimulus might be used to attract and aggregate tuna so that a successful set could be made without the presence of porpoise.

6.4 Other Deficits

Research should be conducted to determine the feasibility of using socio-economic incentives as another way of reducing the kill. The foreign kill might be significantly reduced through international gear development and implementation plans. Additionally, strict import restrictions could be placed on tuna caught in violation of U. S. regulations. Economic incentives directed at the domestic fleet to further reduce mortality might be in order. For instance, the annual kill quota might be apportioned on a vessel-by-vessel basis. When a vessel reaches its allowable kill quota, all further setting on porpoise would be prohibited. A regulation requiring that all porpoise killed be frozen and returned to port might be effective. This would effectively reduce the vessel's tuna-carrying capacity as a function of porpoise killed and would increase the availability of specimens needed for biological analysis.

7.0 PRESENTATION OF NEW IDEAS AND RESEARCH PROPOSALS

This section of the report consists of a series of abstracts. These abstracts have been categorized into three sub-sections: 1) Improvements to traditional gear and methods (involving encirclement of porpoises), 2) improvements leading to new fishing techniques where porpoises are not encircled, and 3) other new proposals.

Certain of the abstracts in this section do not specify such requirements as estimated cost, necessary ship time and special equipment needs. As such, they might better be described as new ideas rather than preliminary proposals.

It was agreed by the workshop committee that the inclusion of statements regarding the relative merit or value of specific proposals could tend to prejudice a more-formal review of the proposals. Consequently statements concerning the relative merit of proposals or ideas are not included in the report. In an effort to avoid the introduction of editorial bias, the following proposals reflect as accurately as possible the statements and claims of the contributors.

7.1 Improvements to Traditional Gear and Methods (Involving
Encirclement of Porpoises)

7.1.1 Project title: Sonic Wand

Submitted by: L.C. Norgaard; Del Monte Corporation

Abstract

Sonic wand to be used by operator of porpoise rescue raft and/or small boats to herd porpoise (by an avoidance sound) toward escape in the backdown area. Experiments to be made by trying different locations within the net as well as different methods of handling the unit.

Estimated Cost: \$500.00

Special Requirements -- Ship Time

Equipment: Two or more units each consisting of an aluminum pole, 10-feet long with an attached self-powered 27-kHz pinger and reflector on one end and a convenient handle on the other. Power - 2 watts.

7.1.2 Project title: Acoustic Simulator

Submitted by: L.C. Norgaard; Del Monte Corporation

Abstract

To be carried by the tuna vessel and hung under water using the ship's port side as a sound reflector creating a pulsing variable frequency sound of an avoidance type to herd porpoise toward and over the escape area in the backdown. Best sound combinations and positions of transducer to be determined by experiment.

Estimated cost: \$800.00

Special requirements: Ship time

Equipment: One multiple-frequency sound generator with variable pulse (1-3 sec.) and power output (2-30 watts) as purchased by PRF for this purpose. Unit complete with batteries, transducer and 50 feet of cable.

7.1.3 Project title: Net Pingers

Submitted by: L.C. Norgaard; Del Monte Corporation

Abstract

Use of an avoidance-type sound to channel porpoise toward the escape area during backdown and thereby keeping the animals from fouling in the larger mesh areas of the net. Best location of pingers to be determined by experiment.

Estimated cost: \$3,500.00

Special Requirements: Ship Time.

Equipment: Ten 27-kHz pingers self-powered with rechargeable 2-watt batteries. Pingers equal to those manufactured by Helle Corporation, San Diego, CA.

7.1.4 Project title: Hukilau Control

Submitted by: L.C. Norgaard; Del Monte Corporation

Abstract

A hukilau consists of a floating line, usually with underwater streamers attached at short intervals. It has been demonstrated to effectively herd captive porpoise. Shooting a hukilau across the back-down area will divide tuna from porpoise. Corkline may then be dropped in the escape area to encourage porpoise to leave the net, without the loss of fish.

Estimated cost: \$425.00

Special Requirements: Ship Time

Equipment: 3/4-inch diameter polypropelene line and pendant and one-line gun, such as a "Bridger" shoulder type - USCG approved.

7.1.5 Project title: Space Sound Techniques for Porpoise Rescue

Submitted by: Yugiro Yamamoto, Ph.D.; Y² Associates; Santa Ana, CA

Reference: A proposal to PRF and Tuna Research Foundation (TRF); September 20, 1976 and clarification and modification, dated January 11, 1977. Proposal for dedicated vessel project, January 11, 1977.

Abstract

Ever since the introduction of the purse-seine approach to tuna fishing there has been growing concern for the incidental mortality of porpoises. There are three fundamental alternatives to the ultimate solution for porpoise rescue; namely:

- (1) Control tuna
- (2) Separate tuna and porpoise
- (3) Control porpoise

Effective exercise of the above will result in a reduction of porpoise mortality and a probable increase in the efficiency of the tuna catch. The proposed techniques are basically to utilize conditioned (in

nature) and logical reflexes of the subjects prior to or during the initial phase of net setting. All techniques are sound and based on known facts and accumulative experiences of the project team and YACK/YACK transducer technology. A part of engineering support is provided by Sound-Wave Systems, Inc. The technique proposed and the major groups of experiments planned through three phases of the research efforts are:

GROUP I: SPACE-SOUND APPLICATION to control (or guide) movement of the subjects.

- (1) Experiments evaluating projection of space sound controlling three-dimensional maneuvering and omni-directional radiation and coherency of phase characteristics.
- (2) Experiments related to maneuvering and herding of subjects with space-travelling sound source, which are the basics leading towards porpoise rescue and increased efficiency of tuna catch.

GROUP II: SPACE-DIVISION TECHNIQUE:

- (1) Omni-directional transducers are replaced with directional ones with an estimated lobe of $\pm 15^\circ$ angle at 3 dB down points for setting up a sonic scanning screen.

- (2) Experiments evaluating this tool affecting herding of porpoise and tuna; such as the scanning and dispersion characteristics of the devices, etc.
- (3) Experiments related to initial effect of herding or guiding techniques through control and movable sonic screen in three dimensions.
- (4) Limited experiments dealing with other sensory control means, such as sight, temperature, pressure, etc.

GROUP III: TELEPROJECTION OF OWN SOUND EXPERIMENT:

Experiments in controlled laboratory conditions establishing some facts of bio-control. Also to experiment with electro-acoustic servo system to see if an artificial imaginary path can be established for porpoise or tuna. Other experiments are anticipated stemming from modification, results and data obtained from the above.

Estimated cost of Phase I is \$149,200, excluding the cost incurred on facilities (such as the dedicated vessel) and subjects (porpoise and tuna).

Ship time: June-July 1977, 60 days, including three exclusive periods 6-9 months time (minimum 2 days each) of experimentation. Other

periods are on non-exclusive basis; experiments are run in parallel with other research projects.

Equipment: Details provided in the reference.

Application: When the techniques are proved and refined to the point that they are fully effective, not only the mission of porpoise rescue is accomplished but also it establishes technical basis for improving fishing operation in terms of efficiency in catch and shortening of fishing time.

7.1.6 Project title: Behavioral Observation

Submitted by: Karen Pryor; Porpoise Rescue Foundation

Abstract

I propose to continue observations made on the *Elizabeth C.J.* cruise (1976) as follows:

- (1) Continue to pinpoint details of physiology and behavior, known to me from captive *Stenella attenuata* and *S. longirostris* such as: fatigue symptoms, sex-differential color patterns, fear, threat, courtship and other behavioral displays--so that these things can be recognized and used by other researchers.

- (2) Observe naive and/or panicky animals for possible improvement of handling techniques.
- (3) Extend my observations of learned behavioral responses during the chase, set, and backdown in order to take advantage of learned abilities.
- (4) Observe and make recommendations on physical handling of animals (i.e., where and how to grab a struggling porpoise, etc.).
- (5) Cooperate in development of herding and driving methods in the net.
- (6) Study sub-grouping within schools in the net.
- (7) Observe raft-man performance with the aim of improved training of raft men.
- (8) I would like to be accompanied in this work by one or more experienced *Stenella* observers I've worked with over the years, especially Ingrid Kang or Carol Chang from Hawaii.

Estimated cost: travel and expenses

Special Requirements: Ship Time: 4-8 weeks

Equipment: I will provide

Application (how will this project contribute to solution of the tuna/ porpoise problem).

The literally thousands of hours I and my associates have spent in observing *Stenella* behavior and taking practical advantage of our observations give us a vital edge in understanding not only what the porpoises are doing, but why. More extensive observation cannot help but be illuminating. This understanding will be even more fruitful if it can be transferred on the spot to other researchers. Points (2), (3), (4), (5), and (7) are of immediate practical application. Points (1) and (6) are of general value with possible future application.

7.1.7 Title: Gonsalves Panel Testing at Half-Net and in the Backdown Area

Researcher: John T. Gonsalves, Progressive Fishing Enterprises

Abstract

The principal feature of the Gonsalves panels is insuring consistently controlled corkline submergence. When used in the backdown area they can provide a ramp of entanglement-proof material and an avenue of escape.

However, the panels can also be used to promote pre-backdown escape. Use of a panel configuration at half-net can be used to open the same ramp and avenue of escape so evident in the preliminary testing of MMC Contract #MM6AC 007.

The proposed study will be conducted in two phases. Phase I requires the full-scale testing of Gonsalves panels in the backdown area of an apron/chute net. Objectives are: 1) determine facilitation of corkline submergence caused by panels, 2) develop optimum panel configuration to achieve desired apex width and corkline submergence tendency, 3) test stabilizing effect of panels at sea during normal and simulated gear failure backdown operations, and 4) observe porpoise behavior when confronted with panels. Phase II requires location of Gonsalves panels at a half-net position.

Objectives: 1) observe facilitation of pre-backdown corkline submergence caused by panels, 2) determine best net-control procedures for opening a pre-backdown avenue of escape using the panels, 3) observe porpoise behavior in achieving escape at half-net.

Contributions: 1) greatly improved controllability of corkline submergence, 2) potential stabilization of backdown area to reduce entrapment and entanglement, 3) development of a controllable pre-backdown avenue of escape at half-net, 4) behavioral observations of porpoise when confronted with polyvinyl panels.

*Personnel: John T. Gonsalves (primary investigator) and underwater photographer.

**Special Equipment: Gonsalves panels as provided under proposed extension and re-funding of MMC Contract #MM6AC007.

***Cost: \$2,000 plus an unspecified amount to retain the underwater photographer.

Time: One trip in conjunction with other researchers or 28 days.

7.1.8 Project title: porpoise Response to Low-Level Electrical Stimulation Within a Purse Seine

Submitted by: Fred Wathne; NMFS, Northwest and Alaska Fisheries Center, Seattle, Washington.

Abstract

In recent years low-level pulsed electrical stimulation has been used in numerous experiments to influence the behavior of Penaeid shrimp and sharks. In 1962 the Bureau of Commercial Fisheries initiated

* This assumes a crew and ship are provided.

** Assumes underwater photographic equipment will be available with diver.

*** Assumes crew and boat are provided.

a development program to adapt low-level pulsed dc to the problem of deburrowing shrimp so that trawl fishing could be pursued during daylight hours when these animals are burrowed and unavoidable to conventional trawling gear. Subsequently Westinghouse Electric, Electromagnetics, Inc., and the International Oceanographic Corporation became involved with the shrimp problem as well as with adapting electricity to protecting trawls and gill nets from attack by sharks. In the course of these development activities numerous observations of porpoise in the vicinity of the gear suggested they avoided the electrical field much the way sharks did. Successful application of this phenomenon to clearing purse seines of porpoise would be an economical and practical solution to the problem.

The purpose of the project is to determine the nature of response of porpoise in a seine to low-level pulsed dc electricity with a view to using an avoidance response to move them out prior to the backdown operation.

Immediate objective: Document response patterns of porpoise to various levels of electrical stimulation.

Longer-range objectives:

- (1) Design electrode array capable of herding porpoise to exit zone/zones.

(2) Design and build pulse generator to achieve desired pulse rates and power levels.

(3) Develop array-handling technique and indicated seine modifications.

Estimated cost: \$15,000

Special requirements: ship time: 1 week (local or tuna grounds)

Equipment: None

Application: See above

7.1.9 Project title: porpoise-Releasing Tuna Purse Seine

Submitted by: James M. Seabrooke; Petaluma, CA

Abstract

A tuna fishing purse seine and a method for its operation provide for protection and release of porpoise captured along with a school of tuna. The seine includes an inner, upper net in addition to the main net, positioned alongside the main net and connected to it in one area. The two nets, each having its own corkline, are set together

but may be independently pursed. During setting and pursing, tuna generally sound a considerable distance below the surface, while porpoise tend to remain near the surface for air, so that the porpoise are separated from the tuna by the pursing of the inner, upper net. The pursing of the upper net sweeps it over to one area of the main net, where porpoise can be released by the opening of a release panel or gate in the main net in that area. The captured tuna may then be sacked up in the usual manner, but using the outside of the pursed inner net as a portion of the enclosure retaining the tuna. For a more complete description refer to U.S. Patent 4,006,549

Estimated cost: The net modification cost = ~\$35,000 to \$40,000. The entire modification cost (including the second purse winch) = <\$200,000.

7.1.10 Project title: stern Seining

Submitted by: Mario Puretic

Abstract

The stern seining operation is similar to "setting off the side" but has certain advantages which could reduce the porpoise kill. The net is "set" in a conventional manner, but the pursing is done with the cables running over the stern to the winch. The stern of the seiner

is always facing the net. If the net starts wrapping the boat (the equivalent of bow-stern bends) the main engine can easily propel the boat out of the net, thereby eliminating these potential problem areas. Continued slow revolutions of the main screw would force water into the net and further minimize the potential for collapse. With a stronger forward thrust of the main engine, the corks on the far side of the net could be submerged providing the porpoise in the net with a release area. This system also uses an advantageous fish-loading system where the catch is pulled to the stern. This provides for a more-stable boat, especially during heavy seas or sacking up large catches. The fish are lifted from the sack by a conveyor system. The chain line of the net is wrapped around a lip on the stern aperture of the conveyor, as the volume of the net is reduced the fish are forced on the conveyor. A revolutionary swinging A-frame structure is also utilized to hold the rings after they have been lifted clear of the water.

Stern seining, because it improves the boat's stability, can accommodate the use of two power blocks to simultaneously "roll" both ends of the net. This could speed up the set and reduce the amount of time the porpoise spend in the net, which should help reduce the porpoise kill.

Submitted by: Rafael Guillen; Guillen Enterprises Co.

Abstract

The snap link is a patented quick-release device that releases upon demand under pressure. It is connected to the purse ring then attached to the chain bridle. This makes the detachment and replacement of the purse rings fast and economical to the industry. Normally the purse rings and chain bridle are attached with nylon twine seizings, making their removal expensive and very slow.

By rolling the net while it is being pursed with the use of the snap link the net can be rolled as soon as the stern ortza (end of net) hits the davit. As the net is being rolled the rings are carried to the boat on the purse line. A crewman using a 3-foot long hook reaches over the rail and the snap link slides back into the water while the net continues on through the block.

Advantages during porpoise sets

- (1) Elimination of stern bend, thereby reducing chances for a net collapse and probable associated porpoise mortality in that area of the net.

Advantages during both porpoise and schoolfish sets

- (1) A significant decrease in the total time of a normal set is envisioned; the estimated saving is 20-30 minutes.
The time saved during porpoise sets means the porpoise will be backed out that much quicker. If a set on schoolfish yields no fish, the quicker the net is onboard, the sooner one can set again. Speed of completion of a set is always to the vessel's economic advantage.
- (2) A significant amount of time may be saved on some sets with gear malfunctions.
 - (a) During the pursing operation, the vessel is pulled toward the net, and bow and stern bends form. The bow bend is reduced by pulling the bow bunches, but frequently the stern bend wraps around the boat and the skiff has to pull the boat out of this bend, before roll net can be attempted. In some cases, the corks get under the stern of the boat or the net gets caught in the propeller and the rolling of the net is delayed until the net is free of the vessel and the boat is in the correct position. If the net is rolled early, this time will be saved.

- (b) If a minor rollup occurs or the net gets entangled in the rings, the problem may be alleviated or reduced by the use of the Guillen snap-link. Many times the net will just fall away from the purse cable as the net is brought to the boat. If a severe rollup occurs and there is an extensive delay in getting the rings onboard, the entire net is difficult to control in the water. By rolling the net early, using the Guillen snap-links, the net can be rolled until the problem area is reached and a net collapse may be averted.

Other advantages

- (1) If the skipper wishes to abort the set for some reason such as porpoise, but no fish, or a massive log and no fish, a few rings on the bow end of the net could be released with the Guillen snap-links. Then the bow end of the net could be pulled from the boat by speedboats and the porpoise, log, or undesirable fish (bullets, for example) released.
- (2) If the net is rolled early, using the Guillen snap-link, the chain and chain bridle are released from the rings and rolled aboard the vessel through the power block.

This reduces the weight on the purse cable as well as reducing the weight of the chain and rings that have to be hoisted, when the rings are put on the stripper. This should reduce wear on the purse cable's "center piece."

Estimated cost: \$25 per link.

Special requirements: None; can be tried on any vessel.

Equipment: Snap link

7.1.12 Project title: Porpoise Evacuation Vessel

Submitted by: Rafael Guillen; Guillen Enterprises Co.

Abstract

The invention is a small skiff-like boat which is deployed from the large tuna seiners and is powered by water jets or like propeller-free means of propulsion so that the vessel can pass freely over the net and over porpoises without endangering the net or the porpoises. The boat is provided with a cockpit area for the operator. A pair of ramps disposed on opposite gunwales of the vessel provide an easy means

for hauling the porpoises up and temporarily storing them in a central bay area, which is preferably disposed slightly beneath the waterline but need not be so. Aside each ramp area are a pair of cages or wells in which fishermen stand and as the boat is maneuvered alongside one or more porpoises the fishermen on each side of the respective ramp may quickly and efficiently haul the porpoises up the ramps and into the central bay area of the vessel. After all the porpoises have been removed from the net area, or when the bay is full, the boat is driven across the edge of the net and a tailgate is released and the porpoises pushed out into the open ocean.

Application: This boat would provide an effective means of rescuing porpoise that refuse to be backed out of the net.

7.2 Improvements Leading to New Fishing Techniques (where Porpoises are not Encircled)

7.2.1 Project title: Alternatives to Using Porpoises for Catching Yellowfin Tuna

Submitted by: Frank Awbrey, San Diego State University; William Evans, Hubbs/Sea World Research Institute; Gary Sharp, IATTC; and Paul Greenblatt, NMFS.

Abstract

Improvements in gear technology probably cannot reduce in-net porpoise mortality much below 20 thousand per year because most of this

mortality would occur in catastrophic sets due to unpredictable gear malfunctions and breakdowns. At a time when increased efficiency is needed to offset rising costs, efficiency is declining because porpoises now start running sooner and require longer times to capture. These longer chases probably cause increased mortality among young, old, pregnant and otherwise weakened animals. An alternative to chasing and capturing porpoises would satisfy conservationists while possibly increasing efficiency of the purse seining fleet. We believe that such an alternative can be found.

Small tuna (<70 cm) commonly aggregate under flotsam but larger tuna do not. Porpoise are effective aggregators of larger tuna. The basic question which needs answering is; what is the difference between flotsam and porpoises which accounts for the behavioral difference between small and large tuna? This question can be investigated using models which mimic porpoise characteristics such as sound production, mobility, appearance and release of wastes. We propose to perform a set of experiments to determine whether the tuna/porpoise bond can be mimicked and used to aggregate large yellowfin tuna where they will be available to purse seines. If successful, this research should lead to the development of new fishing techniques which would not require using porpoises to locate or catch tuna and which also would eliminate the need to randomly search large areas of the ocean for fish. Radio beacons would tell where the devices were located and whether fish were present. Such devices might also be able to aggregate commercial quantities of tuna in areas of the central Tropical Pacific where fish are now caught only with long lines.

Estimated funding level for the proposed research is about 150-200 thousand dollars per year over a 3-year period. The major portion of support will be requested from NSF/RANN with some matching funds from other sources.

Testing of the porpoise mimic devices will require the services of three or four scientists/technicians on each of three 2-month fishing cruises per year. About 30 devices will be built and equipped with radio location beacons, fish sensors and other apparatus. Sonic tags for tuna and radio tags for porpoises will be needed to supply information about aggregation rates and duration of the bond between tuna and porpoise or other aggregators. A second, smaller vessel will be used to track tagged animals. Boats will require installation of radio direction finders and sonic tracking gear.

7.2.2 Project title: Behavior, pre-Backdown Release Methods and Tuna Attractants

Submitted by: K.S. Norris and W.E. Stuntz, University of California, Santa Cruz, and J. Bardach, University of Hawaii.

Abstract

This proposal covers three related sub-projects. The projects are: 1) a study of behavior of porpoise in the purse seine, wherein the

data base begun in 1976 will be enlarged and refined, 2) evaluation, construction and testing techniques for herding porpoise out of a purse seine, and 3) refinement and testing of tuna attractants, particularly odor, with the goal of being able to control the behavior of tuna in the purse seine. Given this ability, the long-term goal of developing a non-encirclement system may prove to be feasible.

Behavior studies: The behavior studies propose to investigate the reasons for differential mortality between eastern spinner dolphins and whitebelly spinner dolphins, as well as any potential differences in behavior between less-frequently-set-on porpoise and those that have been set on for many years. In addition, we propose to concentrate considerable effort on the backdown period, when much of the porpoise group structure breaks down. Also during backdown we propose to concentrate considerable effort on the behavior of tuna with the goal of recommending modifications to gear and/or techniques that will maintain the separation of species during backdown.

Pre-Backdown release: The pre-backdown release studies will be closely coordinated with NMFS personnel. We propose to develop and test methods for herding porpoise to a location in the net where modifications have been made to facilitate escape of porpoise. The herding techniques under consideration include such items as: a movable corkline, a hukilau, a bubble screen, various acoustic devices and people in rubber rafts. A major consideration in attempting to herd porpoise from

the net prior to backdown is the development of a "gate" of some sort in the net that will allow porpoise to escape when they have been herded into the area. This portion of the problem will be the special domain of NMFS personnel.

Tuna attractants: The ability to control the location of tuna in the purse seine is potentially very valuable in ensuring that all porpoise can be released unharmed. One situation that frequently causes particular difficulty for the fishermen is when the tuna school moves down the backdown channel and gets between the porpoise and their release area. In these situations the porpoise are often driven boatward and the backdown must be slowed in order to avoid losing fish. We are, therefore, proposing to further refine and test the effectiveness, in the field, of chemical attractants.

The field tests will evaluate the effectiveness of the olfactory stimulus in attracting tuna away from certain areas of the purse seine for short periods of time. Depending on the effectiveness of the tests, further experiments utilizing additional stimuli will be worked on. For example, combining a visual stimulus that mimics a bait school in combination with the olfactory stimulus might be much more effective than either stimulus by itself.

Estimated cost: Approximately \$300,000.00

Special requirements - ship time:

The behavior studies will require two fishing trips. Each of these trips will start out in the CYRA, at about 10°N and 109°W. One trip will then go into the southwest portion of the CYRA and the other trip would go west of the CYRA. This pattern will allow us to collect baseline data with which to compare the behavior of animals that have been fished less. The experiments for pre-backdown release and tuna attractants will also require ship time. We believe that two trips will be needed. During the first trip, a series of options will be tested and attempts will be made to evaluate which method should be concentrated on. The effectiveness of a porpoise gate will also be examined. Also, a number of experiments will be run on tuna attractants, using each stimulant by itself and then in combinations.

The second trip will be used to test in detail the final configuration of herding devices and attractants, etc., and to use the system under actual fishing conditions, set after set, in order to evaluate the reliability of the system.

Application: Each of these sub-projects is aimed at decreasing porpoise mortality. If it becomes possible to remove porpoise prior to backdown, the porpoise will be exposed to the hazards of the

net environment for a shorter time and they will thereby be less likely to get in trouble. Containing the tuna in an area away from the porpoise will allow the captains to backdown continuously without being concerned about losing fish and without having fish interfere with the escape of the porpoise. The behavior studies are designed to investigate the behavior of porpoise in the purse seine with the goal of recommending modifications to either gear or techniques that would result in decreasing mortalities.

7.2.3 Project title: Tuna Olfactory Studies

Submitted by: J.E. Bardach; Hawaii Institute of Marine Biology

Abstract

Tuna olfactory studies

Objectives: This work has two objectives. The more immediate of the two is to develop a lure that would attract tuna within the purse seine to an area of the net from which they would be unlikely to escape during attempts at pre-backdown release. This work is mentioned above in the pre-backdown release methods section. The second objective would be to develop a method of tuna fishing that would not rely on encircling the porpoise.

Methods: Considerable progress has been made in refining a compound that will attract tuna. Further pursuit of this program will have a laboratory phase and a closely coupled field phase. The first step will be in the field where we must ascertain currents in the seine under typical "set" conditions so as to be able to release scents in the most-effective manner. Several dye tests in the seine during blind (tuna and porpoise-less) sets must therefore be performed. Representative(s) of the Franklin Institute should attend these tests. Their results will determine design by the Franklin Institute of an effective scent-release mechanism. Tuna behavior is to be studied by divers during pre-backdown phases. At the same time we will work in Hawaii on the concentration and frozen storage of natural prey rinses and prepare a sufficient quantity thereof to perform several field tests. While the scent-release mechanism is being fashioned for later use on the vessel, additional chemical laboratory and tuna tank tests are to be undertaken. These begin in the laboratory, where we will attempt to prepare and test further, the various possible combinations of materials that have been shown effective in eliciting a feeding response from the tuna captive in NMFS Hawaii tanks. These studies of tuna in captivity performed at the NMFS, Hawaii as stated will add no basic cost to the project; also chemical analyses will be undertaken at the Bacterial Biochemistry Laboratory at the University of Hawaii with their analytical apparatus and hence at no cost to the project.

While captive yellowfin tuna are available, we will also perform tests on their reactions to bubble curtains and more tests on their olfactory reactions to filtered elements of *Stenella* feces.

Experiments on guiding tuna by scent can then be attempted in the purse seine. Initially we will test the Franklin Institute scent dispersion mechanism: 1) with dye, 2) with concentrated natural prey rinse and c) with the artificial scents. If the tuna respond well to the material under 2) we will work with the porpoise-release team to develop realistic methods, so that tuna could be lured away from the porpoise during pre-backdown. If we are successful in doing so with concentrated natural prey rinse, we will proceed to 3) and try two or three of the most-successful synthetic scents as ascertained in tank tests.

If the tuna attracting capabilities of these latter mixtures or other second-generation, more-potent ones (as ascertained by further tank bioassays) turn out to be reasonably effective in the purse seine, we intend to expand our efforts into an attempt to catch tuna without porpoise. One obvious method would be to launch a platform to dispense the odor compound and then make sets on this artificial log at intervals to see if tuna have been attracted. Another feasible technique would be to attempt to lure tuna away from a porpoise school by creating a curtain of the lure compound as follows: A porpoise school is located that is carrying tuna. Speedboats are sent out to herd the porpoise school past a trail but the tuna would stop. The purse seine would then be set on the tuna alone. In order to test this concept, it would be necessary to have a device for dispensing the odor, so that the tuna would be certain to intercept the odor trail. Ideally the odor trail would have a gradient

sharp enough that the tuna would be led into a small area where the net could be set. The Franklin Institute will be prominently involved in developing the system for dispersing the odor in this case.

Time frame: As soon as a dedicated vessel is available, dye testing and tuna-behavior observations should commence; about 1 month of technician time is envisaged for this phase. It is expected that assembly of odor-release mechanism(s) to be tried out at sea will take 2-3 months; cooperation (part-time) of one of our technicians with Franklin Institute personnel is planned. Concentration of natural scent can be completed 3 months after funding has been obtained while synthesis and testing of the artificial lures to be used in these experiments would require 3-6 months after funding has been obtained. We envision experimenting on an early cruise of the dedicated vessel, followed by an intensive period of onshore work, where equipment is constructed and tested and more chemical work is completed. A second cruise would follow 3-6 months later for testing and evaluation of the techniques. If logistics of associated studies permit, two chemical-testing cruises with a 3-month interval would be desirable. This phasing would permit iterative refinement of all techniques. These experiments can be conducted on the same cruises as those involved in pre-backdown release studies. Whether or not scent-herding of tuna for sets without porpoises can be attempted within the confines of this proposal will depend on the success of all phases up to that stage.

Impact on fishing during testing: We estimate that this type of experimentation will rather seriously impact the normal fishing operations aboard the test vessels and would expect the catch to under 20% of what could normally be expected. This impact is due mainly to our slowing operations to a great extent. Each set will require that the weather be good, at least in the early stages of testing, and we may attempt several experiments during a set. Thus, no more than one set per day can be expected.

7.2.4 Project title: Acoustic Modeling of the Dolphin/Tuna
Associative Behavior with Applications to the Dolphin/Tuna
Problem

Submitted by: James W. Fitzgerald; Woodmont Assoc., Ltd.

Abstract

Through an astonishingly complex and ingenious functional anatomy, the bio-acoustic apparatus of the dolphin enables him to operate four separate sonar systems more-or-less simultaneously, using some of the anatomical components in common (Fitzgerald, 1968). These systems are: 1) a high-frequency (~ 30 -150 kHz) echo-location "attack" sonar, with a narrow ($\sim 5^\circ$) forward-looking beam pattern and short-range (~ 100 yards), that is used for location, delineation, and tracking of individual targets, such as foodfish, 2) a low-frequency (< 30 kHz) echo-location

"search" sonar, with a broad ($\sim 180^\circ$) forward-looking beam pattern and long-range (~ 2000 yards), that is used for orientation, intruder detection, and long-range search for fish schools; 3) an audio-frequency (~ 0.5 - 15 kHz) FM "communication" sonar, with a non-directional beam pattern, that is used for "talk" between dolphins; and finally, 4) a wide-frequency band (~ 0.5 - 150 kHz) passive "listening" sonar, with binaurally "preformed" beams, that is used as a sonar receiver for all three of the preceding active sonars, as well as a passive listening system for target detection, bearing, and classification.

For typical values for surface-duct transmission losses and typical values of the target strength of fish schools, preliminary calculations using the sonar equations and the dolphin search sonar, indicate that the dolphin should be able to detect schools of food-fish at ranges of ~ 1 nautical mile for background noise conditions equivalent to sea-state 3. This detection capability is, of course, not dependent on light illumination, and is equally effective at night.

The tuna, by contrast, depending principally on visual sightings, are limited to food-fish school detection ranges of, at best, only a few hundred feet. . .and only during daylight. Olfactory sensors are not considered to be effective or reliable in the open ocean except under special conditions, and then only over short ranges. The tuna's hearing is limited to frequencies below 1000 Hz so that any food-fish

school swimming sounds will be lost in high-level, low frequency sea noise and the self-noise of the tuna themselves. Lateral-line detection, of course, is limited to only a few feet. Thus, we see that the tuna's search range and rate for food-fish is a limited one, and much less than that of the dolphin ($\sim 1:50$).

The key to the dolphin-tuna associative behavior lies in the identification of the communication link or "bond" between the two groups. That this bond might be an acoustic link was first pointed out by the author (Fitzgerald, 1972), who noted that the pulse repetition rates of the echo-location clicks of the dolphin, $\sim 1-400$ pps, are within the hearing frequency range of the tuna. Using the sonar equation for one-way projection and measured values of dolphin-pulse source levels and tuna hearing thresholds, it can be shown that the tuna should be able to detect and track the dolphin's echo-location click-trains at ranges up to ~ 5 nautical miles in sea-state 3 conditions. (It is important to note that none of the dolphin's other phonations are available to the tuna, since they are characterized by frequencies well beyond the tuna's hearing frequency range.)

The echo-location click-trains of the dolphin may, in fact, serve a more sophisticated purpose than that of a simple tracking-target for the tuna. The possibility exists that the dolphin may, either intentionally or unintentionally, be conveying information to the tuna

by modulating his pulse-train. The source of the echo-location clicks is the dolphin larynx, which under flow excitation by air from the lungs, acts as a relaxation oscillator whose pulse repetition rate is given by (Fitzgerald, 1973):

$$F \approx \frac{P_o}{V_o R_o} \cdot \frac{1}{(P'_g - P_g)}$$

where

F = pulse repetition rate (frequency)

P_o = lung (excess) pressure

V_o = volume of the laryngeal pouch

R_o = flow resistance of the tracheal constriction into the laryngeal pouch under the closed condition

P'_g = glottis opening pressure

P_g = glottis closing pressure

The principal control of the pulse frequency is through the glottis pressure term $(P'_g - P_g)$. These glottis pressures, in turn, are controlled by the dolphin through his palatal sphincter muscle surrounding the elongated glottis-spout of the larynx. Thus, the dolphin is capable of pulse-frequency-modulating (PFM) his echo-location click-train such that: 1) the rate at which the instantaneous pulse-frequency varies about the average (or "carrier") frequency corresponds

to the frequency of the modulating (or "audio") signal; and 2) the amount that instantaneous pulse-frequency varies away from the average (the "frequency deviation") is proportional to the amplitude of the modulating signal.

The frequency modulation of the pulse-train is one means of transmitting information. In order to recover the information at the receiving end, some means of "demodulation" is needed. The yellowfin tuna hearing sensitivity curve appears to have the capability of acting as a classical FM discriminator with the characteristic positive slope of ~ 10 - 20 db/octave throughout the principal dolphin pulse-frequency range of 40-400 pps. The significance of this is that, if the dolphin is transmitting information by means of PFM, the tuna should be able to extract the "audio-frequency" modulation information from the pulsed "carrier" frequency. These considerations lead to several possible models of the dolphin-tuna associative behavior. Among these are:

- 1) The tuna, either through learned or inherited behavior patterns (or both), know that dolphin pods will lead them to food-fish and simply follow the echo-location, "carrier" pulse-trains of the dolphins.
- 2) The dolphins, when detecting a school of food-fish, unintentionally and incidentally FM modulate the pulse-train with "audio" patterns signifying food-fish. The

tuna, either through learned or inherited behavior, are able to extract such "audio" information of the pulse-train carrier by means of the discriminator characteristics of their hearing apparatus, and follow the dolphins to the food-fish.

- 3) The pulse-frequency-modulations may, if they exist, be purposive on the part of the dolphins and the tuna may be responding to operant conditioning by the dolphins. Thus, the tuna school could be under the active control of the dolphins. In addition to the associative and joint feeding behavior, this could account for the observations that the so-called "untouchable" dolphins, when taking evasive action from a purse-seiner, often takes the tuna school with them.

The significance of all this with respect to the dolphin/tuna problem is that it may be possible to "acquire" tuna schools by projecting the appropriate PFM acoustic information by means of an underwater projector. The tuna could then be led through an opening into a preset purse-seine. This method, if proved feasible, could revolutionize the tuna industry, as well as solve the dolphin-tuna problem.

A detailed proposal to pursue this work is being prepared for submission to the Marine Mammal Commission, the National Marine Fisheries Service, and the National Science Foundation.

References

1968. DONAR--Underwater Systems Using Operationally Trained Dolphins

1972. DONAR Systems for the U.S. Fisheries Industry with Applications to the Porpoise-Tuna Problem.

1973. A Qualitative Model of the Dolphin Sonar.

7.2.5 Project title: Conspecific Playbacks as Behavioral Stimuli

Submitted by: David Morgan; University of Notre Dame

Abstract

Porpoise transfer information using acoustical signals, in other words, they communicate by sound. If we can develop even a minimum of understanding of the relationships between these signals, we stand a very good chance of being able to develop playback signals with the

signification that we want to convey. The point is that not just any sound in any context can be expected to elicit a response. Indeed, the reason that we do sound playbacks is based on the precept that the sounds have communicatory significance. So, the variables of sound, context of sound, and syntax very greatly affect the signification of a signal and its consequent response.

In the field, using conspecific playbacks, I have been able to affect the behavior of the Beluga, *Delphinapterus leucas*, with statistically significant results, and I contend that if the proper experimental design is developed, this method will be of use in alleviating the porpoise/tuna problem.

The developmental phase would probably be most effective if aimed at enhancing pre-backdown release. Three types of stimuli would be required. The first would be the "primer" or an attention-getting sound. With the Beluga, the "jaw clap" acted as the "primer" and signified that important information was to follow. Second would be a playback of signals emitted by porpoise just prior to or during a successful backdown. And third, would be a playback of signals emitted by porpoise after having been successfully backed out of the net. The two playback signals would be emitted from two small boats, the first signal from within the net, the second from without. The "primer" signal might be introduced from the seiner. For this to be effective it would be necessary to have a net configuration that permitted prebackdown release (i.e., the DaRosa configuration).

An analysis comparing recordings of unmolested schools with captured schools could be valuable in being able to reconstruct or identify signals with the appropriate significance. Artificial situations set up with porpoise in captivity could further refine this signal analysis and additionally provide for a convenient testing ground.

7.3 Other New Proposals

7.3.1 Project title: Long-term Porpoise Tracking

Submitted by: Andrew J. Kemmerer; NMFS, National Fisheries Engineering Laboratory.

Abstract

The National Fisheries Engineering Laboratory (NFEL) and the Southwest Fisheries Center (SWFC), in cooperation with the NOAA Data Buoy Office (NDBO), the Naval Undersea Center, the National Aeronautics and Space Administration, and the Porpoise Rescue Foundation are developing a transmitter for long-term tracking (up to 1 year) of porpoises. The design of the transmitter is predicated on an operational system perfected by NDBO for tracking of drifting buoys and later modified by the U.S. Fish and Wildlife Service for tracking polar bears. The transmitter will operate through NIMBUS-6 initially and ultimately through the TIROS-N/NOAA series of satellites to provide location accuracies of approximately 5 kilometers.

While the electronics of the transmitter appear relatively straightforward, the problem of attaching the transmitters to porpoises has not been resolved. The success of short-term tracking experiments of several weeks duration cannot simply be extrapolated in orders of magnitude without additional tests. These tests will require special facilities and will have to emphasize attachment location, methods, and materials, and size, bulk, and hydrodynamic design of the transmitter packages.

This project would be contracted to an institution, agency, or group possessing adequate facilities and capabilities (porpoise behaviorists, biologists, veterinarians, etc.) to develop, test, and evaluate different attachment methods. Probably a minimum of four captive porpoises would be required, preferably representative of pelagic species. Project duration would be about 1 year.

Estimated cost: \$60,000

Special requirements -- ship time: 10 days to capture test porpoises.

Equipment: Facilities to hold and care for captive porpoises and to conduct tests.

Application: This project will provide the attachment methodology for long-term tracking of porpoises. This tracking will enable an improved understanding of porpoise movements, migrations, and distribution patterns as a function of time, environmental conditions, species, and stock.

7.3.2 Project title: Laser-Triggered Camera

Submitted by: G.A. Gilmour, Ph.D; Westinghouse Oceanic Division, Annapolis, Maryland

Abstract

A mirror-scanned blue-green laser will be mounted in the nose of the survey aircraft. Upon detection of submerged objects (e.g., fish, porpoise) a camera will be triggered to take a photograph in the direction of the detection. This will minimize the human element in the porpoise school population count, thus standardizing results from year to year and lessening criticism of the subjectiveness of the surveys.

Estimated cost: To be determined.

Special requirements: aircraft time and ground truthing from boat.

Equipment: Blue-green laser and cameras.

8.0 SUMMARY AND CONCLUSIONS

This section expresses a generalized consensus of opinion as evident in presentations and discussions having taken place throughout the course of the workshop. Workshop participants were agreed that the 1976 research program had provided meaningful results. The studies carried out aboard the *Elizabeth C.J.* and the *David Starr Jordan* contributed new insight into the nature of the porpoise/tuna problem, and suggested new approaches to further reduce incidental mortality and serious injury of porpoise.

Each element of the present 1977 research plan was deemed relevant and necessary; however, certain deficiencies were discussed: 1) that there has been inadequate effort to develop alternative methods for assessing the status of impacted porpoise stocks; the sub-tasks aimed at calibrating teeth layers (rings per year) and tag development (both field recovered and satellite tracked) need further augmentation, 2) that there has been inadequate effort to assess and validate the assumptions upon which population and mortality estimates are based (the biological parameters of the impacted stocks are defined by kill samples and the degree to which these samples reflect entire school structures has not been determined), and 3) that there has been little effort spent to devise fishing systems that do not involve the harassment or capture of porpoise.

It was agreed that great strides have been made in the areas of fishing gear design and procedural improvement. It is unlikely that we can realistically expect any more major breakthroughs in purse seining technology. Further improvements will very likely involve relatively minor modifications to existing developmental configurations. Improvements of this type would include a closer examination of pre-backdown release methods, use of the purse ring "snap links" to reduce problems with "stern bends" and certain malfunctions, and development of technology to reduce the incidence of rollups. Now the implementation of these improved gear types and methods within the U.S. tuna purse seine fishery should be a high priority matter. It is expected that implementation of existing technology through a comprehensive extension program would substantially reduce the porpoise kill. It was noted that since the gear is moderately costly (\$18,000) and since it hasn't greatly increased fishing efficiency, only a marginal incentive is provided to encourage its adoption by foreign-flag fishermen. Because foreign-flag fishermen kill significant numbers of porpoise and since the number is likely to increase rather than decrease, this experimental gear will meet the goal of the MMPA only if its adoption can be somehow imposed internationally, as well as domestically.

Participants agreed that the 1977 research program should emphasize stock assessment and mortality reduction (see Sections 6.1 and 6.3), and that attention should be paid to seeking fishing methods

which do not require setting on porpoise, not losing sight of the immediate need to complete existing developmental work and see that the existing techniques are implemented throughout the U.S. fleet. Several proposals addressed subjects related to alternative fishing practices (see Section 7.2) and, although the proposals represented "high risk" research, most participants felt they should receive serious consideration for support and inclusion in the research program.

The 1977 research plan was developed under the assumption that the industry would provide a full-time, dedicated vessel. The general view was that a meaningful program to work on many of the ideas presented in this report could not be carried out without this degree of logistic support, and little thought was given, therefore, to consideration of alternative plans. Most of the presentations and discussion were predicated on the assumption that the vessel would be available.

APPENDIX I

LIST OF ATTENDEES

1. Dimitri Abramenkoff; NMFS/Southwest Region
2. Gerry Alisio; NMFS/Southwest Fisheries Center
3. Frank Awbrey; San Diego State University
4. Anthony Ayers; San Diego State University
5. John Bardach; University of Hawaii/Hawaii Institute of Marine Biology
6. Joel Bird; NMFS/Southwest Region
7. Serge Birk; NMFS/Southwest Region
8. Robert Brumsted; NMFS/Washington, D. C.
9. Mark Becker; NMFS/Southwest Region
10. Harold Cary; Ocean Fisheries, Inc.
11. Bruce M. Chatwin; Zapata Ocean Resources Corp.
12. Ruth Cheney; American Cetacean Society
13. James Coe; NMFS/Southwest Fisheries Center
14. Eleanor Coerr; Monitor, Inc.
15. Wymerly Coerr; Monitor, Inc.
16. Vic Cox; Science Digest
17. John DeBeer; Porpoise Rescue Foundation
18. Mike Deerman; NMFS/Southwest Region
19. R.D. Doolittle; Woodmont, Ltd.
20. John Eikelman, Jr.; Stanford Research Institute
21. William Evans; Hubbs/Sea World Research Institute
22. John Everett; NMFS/Southwest Fisheries Center
23. James Fitzgerald; Woodmont, Ltd.
24. W.F. Flanigan; Naval Ocean Systems Center
25. Robert Fountain; NMFS/Southwest Fisheries Center
26. John Frederick; NMFS/Southwest Fisheries Center
27. Robert Gibson; Franklin Institute Labs
28. George Gilmour; Westinghouse/Oceanic Division
29. Judy Goldman; American Cetacean Society
30. John Gonsalves; Progressive Fishing Enterprises
31. B. Gordon; University of California, Santa Cruz
32. Dan Greenblat; Progressive Fishing Enterprises
33. Paul Greenblatt; NMFS/Southwest Fisheries Center
34. Joseph Greenough; IATTC
35. Rafael Guillen; Guillen Enterprises Co.
36. Alan Hansen; NMFS/Southwest Region
37. John Henderson; NMFS/Southwest Fisheries Center
38. Bob Hofman; Marine Mammal Commission
39. David Holts; NMFS/Southwest Fisheries Center
40. Clifford Hui; Naval Ocean Systems Center
41. Walter Ikehara; University of Hawaii/Hawaii Institute of Marine Biology
42. Nick Iorio; NMFS/Southwest Fisheries Center
43. Jose Itchon; Bumble Bee Seafoods

44. Jacqueline Jennings; NMFS/Southwest Fisheries Center
45. Tom Kane; NMFS/Southwest Region
46. Andrew Kemmerer; NMFS/Southeast Fisheries Center/National Fisheries Engineering Laboratory
47. Makato Kimura; NMFS/Southwest Fisheries Center
48. John Kriegsman; NMFS/Southwest Region
49. Steve Leatherwood; Naval Ocean Systems Center
50. Darrell Lee; NMFS/Southwest Region
51. Richard Lee; NMFS/Southwest Region
52. Robert Leonard; Stanford Research Institute
53. Don Ljungblad; Naval Ocean Systems Center
54. Nancy Lo; NMFS/Southwest Fisheries Center
55. Rodney McLain; NMFS/Southwest Fisheries Center
56. Richard McNeely; NMFS/Southwest Fisheries Center
57. Forrest Miller; IATTC
58. Edward Mitchell; Environment Canada
59. David Morgan; University of Notre Dame
60. Ben Morris; Y² Associates
61. Eleanor Mosca; American Cetacean Society
62. Chris Norgaard; Del Monte Corp.
63. Kenneth Norris; University of California, Santa Cruz
64. Kevin O'Leary; NMFS/Southwest Region
65. Millie Payne; American Cetacean Society
66. William Perrin; NMFS/Southwest Fisheries Center
67. Bill Powell; Naval Ocean Systems Center
68. Joe Powers; NMFS/Southwest Fisheries Center
69. Karen Pryor; Porpoise Rescue Foundation
70. Mario Puretic; Interested Party
71. Frank Ralston; NMFS/Southwest Fisheries Center
72. Robert Read; NMFS/Southwest Region
73. Lee Ross; Project Jonah
74. Joe Scordino; NMFS/Southwest Region
75. Gary Sharp; IATTC
76. Tim Smith; Marine Mammal Commission
77. George Sousa; M.V. Raffaello
78. Lionel Sousa; M.V. Marco Polo
79. Harold Spuhler; National Science Foundation
80. Pat Tomlinson; IATTC
81. Ron Wong; NMFS/Southwest Region
82. F.G. Wood; Naval Ocean Systems Center
83. Bernd Wuersig; State University of New York at Stonybrook
84. Yugiro Yamamoto; Y² Associates

APPENDIX II

Status of the Dedicated Vessel

Introduction

The Marine Mammal Commission requested that the Porpoise Rescue Foundation (PRF) fund a dedicated vessel for porpoise research during 1977. In response to this request, a group consisting of John Mulligan and Frank Alverson of PRF; Harold Cary of Ocean Fisheries; Ken Norris, University of California, Santa Cruz; Robert Hofman, Marine Mammal Commission; Bill Fox and Bill Perrin, National Marine Fisheries Service; and Mike Zolezzi, American Tunaboat Association, met on November 9, 1976, to rough out a tentative one-year program. The plan was developed for consideration by the principals that fund the PRF.

On January 4, 1977, another group of 26 interested people met to discuss and review the preliminary plans developed on November 9, 1976, and to solicit new ideas. Representatives of PRF; Marine Mammal Commission; University of California, Santa Cruz; National Marine Fisheries Service; Sound Wave Systems; Stanford Research Institute; Inter-American Tropical Tuna Commission; San Diego State University; Hubbs-Sea World Research Institute; Del Monte Corporation; Bumble Bee Seafoods, Ocean Fisheries; Star-Kist Foods; Y² Associates and a Canadian Government Scientist were present.

Those present felt that more proposals might be submitted and set January 10, 1977 as the deadline for receipt of additional proposals. This was

due to the very limited planning time-frame thought to be available.

Dr. W. Fox suggested that all project proposals contain the following information:

- 1) Objectives of research.
- 2) Operation - how.
- 3) Time - period, year, length at sea.
- 4) Geographical area of interest.
- 5) Number and kind of people required.
- 6) Equipment required.
- 7) Funding base.
- 8) Impact on fishing/saving porpoise.

A task force, consisting of Frank Alverson, Chairman; Warren Stuntz; Jim Coe or Dick McNeely; Dough Chapman and Bill Evans; was formed to consider all proposals, set priorities and formalize the overall program for presentation to the principals of PRF. The first meeting of the task force was set for 10:00 a.m. Tuesday, January 11, 1977, at the National Marine Fisheries Service Laboratory in La Jolla.

Task Force

The Task Force met on January 11 and 12 to review all proposals and to draw up a tentative schedule for the dedicated vessel. Present on January 11th were Doug Chapman (MMC), Bill Evans (Hubbs-Sea World Institute), Warren Stuntz (UCSC), Bill Fox (NMFS), Dick McNeely (NMFS), Frank Alverson (PRF) and John DeBeer (PRF). On January 12th, Doug Chapman was absent. Bill Fox was absent for the morning session; however, John Everett (NMFS) was present for the morning meeting.

Four proposals were submitted for consideration by the Task Force and the general projects contained therein were as follows:

1) National Marine Fisheries Service

- whole school examination,
- tagging,
- production of a training film (joint with PRF),
- Advanced gear traing and demonstration (joint with PRF).

2) Ken Norris - University of California, Santa Cruz

J. Bardach - University of Hawaii

Chris Norgaard - Del Monte Corporation

- tuna/porpoise behavior,
- develop and test methods of pre-backdown release of porpoise,
- alternatives to present fishing methods,
- use of acoustic simulators to guide porpoise.

3) Frank Awbrey - San Diego State University

William E. Evans - Hubbs-Sea World Research Institute

Gary Sharp - Inter-American Tropical Tuna Commission

Paul Greenblatt - Scripps Institute of Oceanography

- artificial aggregating devices for yellowfin tuna,
- use of sound, "food odors" or a combination of both from aggregating devices.

4) Y Square Associates, Inc.

- use of acoustics to control tuna, separate tuna and porpoise, control porpoise.

Discussion

Subsequent to a thorough discussion of all proposals, a tentative schedule of the research activity by organization, type and trip, was drawn up. Five trips, three of 56 days each, one of 53 days, and one of 51 days (for a total of 272 days at sea) are contemplated. Port time between trips has been scheduled as follows:

Between trips 1 and 2 - 15 days

Between trips 2 and 3 - 16 days

Between trips 3 and 4 - 48 days

Between trips 4 and 5 - 14 days

In addition to research activity on the regular trips, it is anticipated that the vessel will be used for one-day trips off San Diego during the periods designated as port time. Local testing, demonstrations and advanced training are anticipated during these periods.

All members of the Task Force agreed that the dedicated vessel program must have a scientific manager and that he should be brought aboard as soon as possible.

The Funding Situation

National Marine Fisheries Service and Porpoise Rescue Foundation budget for fiscal year 1977 can cover the projects proposed by these organizations. The IATTC allocation of 1,000 tons of yellowfin tuna

within the CYRA for porpoise research may be available from NMFS for use by the dedicated vessel as required. The Marine Mammal Commission has offered to pay for the costs of a scientific manager. The Universities of California at Santa Cruz and Hawaii hope to receive monies from the MMC and other federal sources. Awbrey, et al., anticipate funding from the National Science Foundation - Research Applied to National Needs (RANN) and, for an early start-up, from the PRF. Y Square Associates have submitted their proposal to PRF for funding.

NMFS can expand its proposed program and fill in any time gaps created by lack of funding by some of the groups submitting proposals. The vessel can be kept busy for a year on worthwhile scientific projects.

National Marine Fisheries Service - Research Vessels

The porpoise program at the Southwest Fisheries Center has been budgeted for the use of the David Starr Jordan in the latter part of 1977. Subject to the priorities of NMFS' overall porpoise research program, the Jordan may be available to work in conjunction with the dedicated vessel.

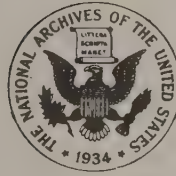
Requirements of the Dedicated Vessel

The dedicated vessel should be a modern vessel of sufficient size to carry a scientific party of four, in addition to the crew, have the physical

ability to fish outside the CYRA and be equipped with a bow thruster. Said vessel should be in good mechanical condition. It should be captained and crewed by men sympathetic and compatible with the research goals of the PRF and the idiosyncrasies of scientists and their work.

TUESDAY, MARCH 1, 1977

PART V



DEPARTMENT OF COMMERCE

**National Oceanic and
Atmospheric Administration**



TAKING AND IMPORTING OF MARINE MAMMALS

Commercial Fishing Operations

Title 50—Wildlife and Fisheries

CHAPTER II—NATIONAL MARINE FISHERIES SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

PART 216—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

Taking of Marine Mammals Incidental to Commercial Fishing Operations

Final regulations are herein published to implement the final decision in the matter of the promulgation of such regulations authorizing the issuance of a permit to allow the taking of marine mammals incidental to yellowfin tuna purse seine fishing in the eastern tropical Pacific Ocean and governing the importation of yellowfin tuna. Proposed regulations on this matter were published on October 14, 1976, 41 FR 45015. The final decision is simultaneously published at page 12015 of this issue.

SUMMARY OF AMENDMENTS

1. Section 216.24(c)(5)(vi) has been added to require that a Category 2 certificate applicant document the status of the fine mesh webbing required on the vessel on which he intends to operate.

2. Section 216.24(d)(2)(i)(A) has been amended to add two subparagraphs. Subparagraph (1) has been added to prohibit the encircling of pure or mixed schools of coastal spotted dolphin, Costa Rican spinner, and eastern spinner dolphin stocks. Subparagraph (2) has been added to restrict encircling of pure schools to offshore spotted dolphin stock and common dolphin species only. The paragraph has been also amended to reflect the Director's method of assessing the separate stock mortalities in 1977.

3. Section 216.24(d)(2)(H) has been amended to clarify the requirement that marine mammals incidentally taken in commercial fishing operations may not be retained.

4. Section 216.24(d)(2)(iii) has been amended to clarify where logs are to be sent.

5. Section 216.24(d)(2)(iv) has been amended for clarification.

6. Section 216.24(d)(2)(iv)(A) has been deleted and new subparagraphs (1) and (2) have been added to describe in detail the required installation of new fine mesh webbing on different classes of purse seiners.

7. Section 216.24(d)(2)(iv)(E)(i) has been renumbered as § 216.24(d)(2)(iv)(E).

8. Section 216.24(d)(2)(iv)(E)(ii) has been renumbered as § 216.24(d)(2)(iv)(F) and its language amended to clarify placement of bunnies.

9. Section 216.24(d)(2)(iv)(E)(iii) has been renumbered as § 216.24(d)(2)(iv)(G) and its language amended for clarification. Furthermore, a documentation requirement has been added for certificate holders on Class I vessels desiring to be granted a waiver of the two speed-boat regulation.

10. Section 216.24(d)(2)(iv)(E)(iv) has been renumbered as § 216.24(d)(2)(iv)(H).

11. Section 216.24(d)(2)(v) has been renumbered as § 216.24(d)(2)(iv)(I) and the last two sentences have been transferred to the following new section.

12. Section 216.24(d)(2)(iv)(J) has been added to incorporate all the personnel requirements of porpoise rescue other than backdown, including adding a requirement for use of an inflatable rubber raft and facemask.

13. Section 216.24(d)(2)(iv)(K) has been added to require use of floodlights and searchlights in sets which continue after darkness.

14. Section 216.24(d)(2)(vi) has been renumbered as § 216.24(d)(2)(iv)(L) and has been amended to require an annual inspection of all purse seine vessels used by certificate holders, and to allow vessels unable to install the new fine mesh safety panel due to supply delays, to continue fishing until the webbing can be delivered.

15. Section 216.24(d)(2)(vi) has been renumbered as § 216.24(d)(2)(iv)(M) and has been amended to make suspension or revocation of a certificate a penalty for lack of proficiency in required release procedures, and recognizes the advisory capability of an established "Skipper's Panel" in determining proficiency of certificate holders.

16. Section 216.24(d)(2)(viii) has been deleted.

17. Section 216.24(d)(2)(ix) has been renumbered as § 216.24(d)(2)(iv)(N) and has been amended to add, as a requirement of the general permit application, documentation that the requested take is consistent with the purposes of the Act.

18. Section 216.24(e)(2)(i) has been amended to list all categories of fish, other than yellowfin tuna, which require documentation under these regulations.

19. Section 216.24(e)(2)(ii) has been added to list those categories under which yellowfin tuna is imported, and for which documentation under these regulations is required.

20. Section 216.24(e)(3) has been amended to reflect the use of a revised documentation form for importation of fish categories other than yellowfin tuna.

21. Section 216.24(e)(3)(v) has been deleted, as have subsections (A) and (B) thereunder. Statements under this section are no longer relevant.

22. Section 216.24(e)(3)(vi) has been renumbered as § 216.24(e)(3)(v).

23. Section 216.24(e)(4) has been added to establish the documentation requirements for yellowfin tuna products.

24. Section 216.24(e)(5)(i) has been added to prohibit unloading of yellowfin tuna from those countries whose vessels the Director has determined operate in the eastern tropical tuna purse seine fishery, unless documentation can be provided which allows him to determine that their fishing operations conform with our regulations and standards.

25. Section 216.24(e)(5)(ii) has been added to describe the procedures by

which countries, listed by the Director pursuant to § 216.24(e)(5)(i), can apply for a finding of conformity with our regulations and standards.

26. Section 216.24(e)(4) has been renumbered as § 216.24(e)(6) and amended to reflect other renumbered sections.

27. Section 216.24(e)(5) has been renumbered as § 216.24(e)(7) and the 5 day redelivery deadline amended to be 30 days, in line with normal U.S. Customs procedures.

28. Section 216.24(e)(6) has been renumbered as § 216.24(e)(8) and amended to reflect other renumbered sections.

29. Section 216.24(f) has been amended to remove the requirement for a five day advance notice of departure for observer placement, and has added a requirement that accurate locations be supplied to the observer.

30. All Figures pertaining to § 216.24(d)(2) have been deleted. Sections 216.24(d)(2), 216.24(e) and 216.24(f) have been hereby published in their entirety to provide continuity and clarity in the regulations.

Dated: February 24, 1977.

ROBERT W. SCHONING,
Director, National
Marine Fisheries Service.

Section 216.24 is hereby amended by adding a new subparagraph (c)(5)(vi), and by amending paragraphs (d)(2), (e), (f) and (g) as follows:

§ 216.24 Taking and related acts incidental to commercial fishing operations.

(c) Certificates of Inclusion: * * *

(5) * * *

(vi) For 1977 only, all applicants for a Category 2 Certificate shall either, (A) provide a statement that small mesh webbing not exceeding 1 1/4" stretch mesh has been installed in the net of the vessel he intends to operate as required by (d)(2)(iv)(A) below; or (B) provide a statement that small mesh webbing not exceeding 1 1/4" stretch mesh is on order giving the expected delivery date. The Regional Director may require further documentation verifying an order for fine mesh webbing prior to issuing a certificate.

(d) * * *

(2) Encircling gear; yellowfin tuna purse seining. (i) (A) A certificate holder may take marine mammals so long as taking is an incidental occurrence in the course of normal commercial fishing operations, except that a certificate holder shall not encircle either (1) pure schools of coastal spotted dolphin (*Stenella attenuata*), and Costa Rican spinner or eastern spinner dolphin (*Stenella longirostris*) stocks or mixed schools including these stocks, or (2) pure schools of any species of dolphin except offshore spotted dolphin (*Stenella attenuata*) stocks and common dolphin (*Delphinus delphis*) stocks. The numbers of marine mammals that may be killed by U.S. vessels in the course of commercial fish-

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ing operations will be determined by the Director and limited in the general permit. The mortality of marine mammals permitted under the general permit for yellowfin tuna purse seining, will be monitored according to methodology which will be published in the FEDERAL REGISTER. The effective date when fishing on a stock or species will be prohibited, will be published in the FEDERAL REGISTER not less than 7 days prior to that date. The Director may change the maximum number of marine mammals that may be killed, as specified in the general permit, whenever new information becomes available which results in the reevaluation of the population or OSP level of any stock or species.

(B) Marine mammals taken incidental to commercial fishing operations shall be immediately returned to the environment where captured without further injury. Each certificate holder shall take every possible step to minimize the incidental mortality and serious injury of marine mammals in the course of commercial fishing operations, including refraining from using a sharp or pointed instrument on porpoise and refraining from causing or permitting a purse seine under his control to be set around marine mammals when conditions of wind, sea, visibility, or the number of marine mammals and/or fish concerned would, in his judgment, be likely to prevent the effective use of the backdown and other procedures required herein. Such steps to minimize mortality and serious injury shall include, where appropriate, causing a purse seine already set on marine mammals to be released, and/or opened to facilitate release of marine mammals where such a step will, in his judgment, be effective and conditions prevent the effective use of the procedures required hereunder. The Director may publish findings relating to conditions of wind, sea, visibility or numbers of marine mammals and fish concerned which prevent the effective use of equipment and procedures required hereunder and result in an unacceptably high rate of incidental mortality and serious injury of marine mammals and under which conditions it would not be permissible to cause a set to be made on marine mammals.

(i) A certificate holder may take such steps as are necessary to protect his catch, gear, or person from depredation, damage, or threat of personal injury. However, all marine mammals taken in the course of commercial fishing operations shall be subject to the provisions of §216.3 with respect to "incidental catch", and may not be retained except where a specific permit has been obtained authorizing the retention.

(iii) All certificate holders shall maintain daily logs, in such form as the Regional Director, Southwest Region, National Marine Fisheries Service may prescribe, of all sets in which marine mammals are taken. Such logs must include the location, time and date of set; weather and water conditions; estimated number and species of marine mammals upon which the set was made; estimated

number and species of marine mammals caught; method used to remove marine mammals from the net; amount and kind of tuna caught; and an actual count of marine mammals killed and seriously injured, if any, on each set. Such logs shall be subject to inspection at the discretion of the Southwest Regional Director, or his designated personnel. In addition, certified copies of all such logs shall be mailed or delivered to the field office, Southwest Region, National Marine Fisheries Service, 1140 N. Harbor Drive, Room 7, San Diego, California 92101, within forty-eight hours after arrival in port.

(iv) A certificate will be valid only on a vessel equipped with a porpoise safety panel in its purse seine, and which uses other gear and procedures as described herein. Porpoise safety panels and all other gear used in the course of catching and landing yellowfin tuna, and for backdown and other marine mammal release procedures, shall be maintained in a functional and seaworthy condition. The requirements for the porpoise safety panel and other gear are as follows:

(A) (1) For purse seiners of 400 short tons carrying capacity or less, and for those greater than 400 tons carrying capacity built before 1961, the porpoise safety panel shall be a minimum of 100 fathoms in length (as measured before installation), except that the minimum length of the panel in nets deeper than 10 strips shall be determined at a ratio of 10 fathoms in length for each strip that the net is deep. It shall be installed beginning at the outboard end of the number three bow bunnies, and shall extend toward the stern of the net, protecting the perimeter of the backdown area. The porpoise safety panel shall consist of small mesh webbing not to exceed 1 1/4" stretch mesh, extending from the corkline downward to a minimum depth equivalent to one strip of 100 meshes of 4 1/4" stretch mesh webbing.

(2) For purse seiners greater than 400 short tons carrying capacity built after 1960, the porpoise safety panel shall be a minimum of 180 fathoms in length (as measured before installation). It shall begin in the second bow bunch at any point between the middle and the outboard end of the bunnies and shall extend toward the stern of the net protecting the perimeter of the backdown area. The porpoise safety panel shall consist of small mesh webbing not to exceed 1 1/4" stretch mesh, extending from the corkline downward to a minimum depth equivalent to two strips of 100 meshes of 4 1/4" stretch mesh webbing.

(B) Each end of the porpoise safety panel must be identified with an easily distinguishable marker.

(C) Throughout the length of the corkline in which the porpoise safety panel is located, hand hold openings are to be secured so that the insertion of a 1 3/8" diameter cylindrical-shaped object meets resistance.

(D) Throughout the length of the corkline in which the porpoise safety panel is located, corkline hangings shall be in-

spected by the certificate holder following each trip. Hangings found to have loosened to the extent that a cylindrical object with a 1 3/8" diameter will not meet resistance when inserted between the cork and corkline hangings, must be tightened so that a cylindrical object with a 1 3/8" diameter cannot be inserted.

(E) Purse seine vessels engaged in fishing operations involving setting on marine mammals shall carry a minimum of two speedboats in operating condition. All speedboats carried aboard purse seine vessels and in operating condition shall be rigged with towing bridle and towlines. Vessels that do not carry at least two speedboats in operating condition and properly rigged, may not conduct fishing operations which involve setting on marine mammals.

(F) On every set involving marine mammals, a minimum of two bow bunnies shall be pulled. Bunchlines, other than bow bunchlines, shall be arranged around the perimeter of the net with both ends of some bunchlines unattached to permit towing from either end or one bunchline rigged in normal fashion with an adjacent one reversed. The arrangement of bunchlines around the perimeter of the net must allow at least three towing points to be established near one-quarter, one-half and three-quarter net from the bow (end of the net). The ends of all bunchlines which can be utilized as towing points shall be marked so as to be clearly visible to speedboat drivers.

(G) Except as provided herein, on every set involving marine mammals, a minimum of two manned speedboats shall be in the water until backdown commences. Speedboats shall be prepared to hook onto either the bunchline towing points established along the perimeter of the net or onto the corkline, in order to tow the net to prevent net collapse and a formation of pockets of loose webbing, such as stern bends, which might entrap marine mammals. Other speedboats that are in operating condition shall be prepared for immediate use to tow if needed. Vessels of 400 tons carrying capacity or less which have an observer duly authorized by the Secretary aboard, may have a minimum of one manned speedboat in the water from the time the set is commenced until backdown has commenced, provided that, prior to departure, the certificate holder has presented the Regional Director with a signed statement declaring that the presence of an observer will displace the crewman who would operate the second speedboat on porpoise sets.

(H) Actual towing on the net shall be performed when, in the opinion of the certificate holder, towing is necessary to prevent net collapse or the formation of pockets of loose webbing. If towing the net has been necessary, the speedboats may unhook their towlines when towing is no longer needed, or their respective bunchlines begin to go up toward the power block or backdown commences.

(I) Backdown shall be performed following a net set where marine mammals are captured in the course of utilizing a purse seine for catching and landing yellow-

lowfin tuna. Thereafter, other release procedures required in paragraphs (J) and (K) below shall be continued until all live animals have been released from the net. "Backdown procedure" means a series of maneuvers, which take place after the net is tied down following a set and pursing; and which keep the net open to the greatest degree to allow porpoise or other marine mammals to leave the pursued net over the net floats which are submerged as a result of the vessel moving astern.

(J) On a net set where marine mammals are captured, a minimum of two men shall be engaged in hand removal of marine mammals from the net, commencing with backdown and continuing through the sacking up operation. (1) A facemask and snorkel, in addition to an inflatable rubber raft suitable to be used as a porpoise observation-and-rescue platform, shall be carried on all tuna purse seine vessels operated by a certificate holder. The raft shall be launched inside the net near the time of tying down for the backdown maneuver and shall be employed by a crewman to assist the other rescuer(s) in disentangling and releasing live marine mammals from the net. The rescuer in the raft shall use the facemask and snorkel to determine whether all live marine mammals are out of the net making every effort to remove them before backdown is terminated. If live marine mammals remain in the net after backdown, the rescuer in the raft shall make every effort to herd the animals to areas where they can be easily released. Rescue efforts using the rubber raft shall be performed using due care for the safety of the rescuer. (2) The rescue procedures above, in conjunction with other rescue efforts, shall be continued until all live marine mammals are removed from the net prior to initiating brailing operations.

(K) All tuna purse seine vessels operated by a certificate holder shall be equipped with adequate floodlights suitable for use in darkness to attract fish toward the main vessel and a spotlight to intermittently illuminate the backdown channel and apex. If the backdown maneuver or other required release procedures proceed past one-half hour after sunset, lights shall be used as necessary, to insure that rescue procedures are properly performed and that all live marine mammals are removed from the net prior to initiating brailing operations.

(L) Purse seine nets and other gear and equipment utilized to catch and land fish under this section and to conduct a backdown and other procedures herein required, shall be maintained in a functional and seaworthy condition. Required vessel gear and equipment shall be subject to inspection and examination at least once annually by authorized NMFS personnel at a time and location determined by the Southwest Regional Director. Any vessel found to not be equipped with gear which is in conformity with these regulations and maintained in a functional and seaworthy condition, or whose master or managing owner has failed to notify the NMFS of delivery of

fine mesh webbing as required below, shall be ineligible for use by a certificate holder for commercial fishing operations under this section. However for 1977 only, a certificate holder may operate a vessel not equipped with the fine mesh safety panel, as required in (A) above, provided that fine mesh webbing has been ordered and documented on his 1977 application for a certificate of inclusion, as specified in paragraph (c) (5) (vi), and that the webbing will be installed and inspected upon its receipt. Webbing delivered while the vessel is still at sea shall be installed and inspected prior to initiating a new fishing voyage. The master or managing owner shall notify the field office, Southwest Region, National Marine Fisheries Service, 1140 N. Harbor Drive, Room 7, San Diego, California 92101, telephone (714) 293-6540 upon delivery of the fine mesh webbing. In no event shall a vessel greater than 400 short tons carrying capacity, not equipped with a fine mesh safety panel, be used by a certificate holder on any fishing voyage begun after 0001 hours, May 1, 1977.

(M) All certificate holders shall maintain proficiency sufficient to perform the procedures required herein. Certificate holders must attend, and satisfactorily complete, a formal training session conducted under the auspices of the National Marine Fisheries Service. At the training session, a certificate holder shall be instructed concerning the provisions of the Marine Mammal Protection Act of 1972, the regulations promulgated pursuant to the Act, the requirements of his certificate of inclusion and the appropriate general permit, and the fishing gear and techniques which are required or will contribute to reducing serious injury and mortality of porpoises incidental to purse seining for yellowfin tuna. In addition, for continuation or renewal of a certificate, a certificate holder may be required to attend other formal training sessions when there are substantial changes in the Act, the regulations or the required fishing gear and techniques. The certificate of any certificate holder who is found to lack proficiency in the procedures required herein shall be suspended or revoked. Determination by the Director to revoke or suspend a certificate may be based on recommendations from a "Skipper's Panel".

(N) Applicants for a general permit under this category, in addition to requirements under paragraph (b) (2) of this section, must demonstrate in the application that the requested taking of species or stocks during commercial fishing operations is consistent with the purposes of the Act and the applicable regulations established under section 103 of the Act. Failure to comply with the provisions of this permit or these regulations, including but not limited to: failure to submit upon demand to vessel, gear, equipment, or proficiency inspection or examination by authorized National Marine Fisheries Service personnel; falsification of logs and reports required hereunder; or failure to satisfy

the requirements of any provisions of these regulations, will subject certificate holders, vessel masters, or owners to revocation of the certificate and/or right to be included under a general permit, and further subject certificate holders, vessel masters, or owners to the penalties provided for under the Act.

(e) Importation: (1) It shall be illegal to import into the United States any fish, whether fresh, frozen or otherwise prepared, if such fish were caught in a manner prohibited by these regulations or in a manner that would not be allowed in circumstances where a person subject to the jurisdiction of the United States would be required to have a certificate of inclusion in a general permit hereunder, whether or not any marine mammals were in fact taken incidental to the catching of the fish, unless the Director makes a finding and publishes such finding in the *FEDERAL REGISTER*, that such fishing, although not in conformity with the specific requirements of these regulations, is accomplished in a manner which does not result in an incidental mortality and serious injury rate in excess of that which results from fishing operations under these regulations.

(2) The following fish and categories of fish, which the Director has determined are involved with commercial fishing operations which cause the death or injury of marine mammals, are subject to the prohibitions and documentation requirements of this section:

(i) Salmon, halibut, and pilchards from South Africa. The following U.S. Tariff Schedule Item Numbers identify these categories of salmon, halibut, and pilchard products which are imported into the United States and are to be covered by the documentation and certification regulations of §216.24(e) (3):

110.20-25	Halibut, fresh or chilled.
110.20-30	Halibut, frozen.
110.20-45	Salmon, fresh or chilled.
110.10-50	Salmon, frozen.
110.70-40	Halibut, other—except portion controlled steaks.
111.48-00	Salmon, salted.
111.88-00	Salmon, smoked or kippered.
112.18-00	Salmon, preserved, not in oil.
112.20-00	Canned sardines/pilchards (from S. Africa).
112.22-00	Canned sardines/pilchards (from S. Africa).

(ii) Yellowfin tuna. The following U.S. Tariff Schedule Item Numbers identify the categories of tuna and tuna products under which yellowfin tuna is imported into the United States, and are subject to the importation restrictions of paragraph (e) (4) of this section after May 31, 1977:

110.10-20	Tuna; yellowfin, whole fish.
110.10-25	Tuna; yellowfin, eviscerated, head on.
110.10-30	Tuna; yellowfin, eviscerated, head off.
110.10-37	Tuna; yellowfin, other.
112.30-40	Tuna; canned, other than white meat, no oil—except cans marked "Other than yellowfin tuna".

- 112.94-00 Tuna; canned, other, no oil—except cans marked "Other than yellowfin tuna".
- 112.90-00 Tuna; canned, other, in oil—except cans marked "Other than yellowfin tuna".

(3) Salmon, Halibut, and Pilchards from South Africa. All fish and categories of fish listed in paragraph (e) (2) (i) of this section shall be denied entry into the United States unless accompanied by a separate Fisheries Certificate of Origin (Standard Form 369-1) from each country whose flag vessels caught fish involved in the importation. The Fisheries Certificate of Origin should include the following information:

- (i) The country of origin; and
(ii) The identity and quantity of fish; and, either

(iii) After the Director has published the finding referred to in paragraph (e) (1) of this section, a statement from a responsible official of the country of origin that the fishing technology permitted by the country of origin with respect to the species of fish presented for importation into the United States does not result in a rate of serious injury or death to marine mammals in excess of that which results from U.S. commercial fishing operations as prescribed by these regulations. Country of origin for the purposes of this section shall mean the country under whose flag, the fish catching vessels are documented and whose fish are a part of any cargo or shipment of fish to be imported into the U.S. regardless of any transshipments; or

(iv) A statement by a responsible official of the country of origin or the master of the vessel which caught the fish that such fish were not caught in a manner prohibited for U.S. fishermen by these regulations. The statement shall identify the species, quantity, and exporter of the fish to which the statement refers; or

(v) Any nation may certify to the Director either (A) that all of its vessels fishing under its flag are fishing in conformance with these regulations; or (B) a list of the vessels, by name and official number, fishing under such nation's flag which are fishing in conformance with these regulations; or (C) that all of the vessels fishing under such nation's flag, with the exception of any vessels specifically listed by name and official number, are fishing in conformance with these regulations. If methods (B) or (C) are used, the shipping documentation must also show the name and official number of the vessel which caught the fish presented for importation.

(4) Yellowfin tuna. Prior to June 1, 1977, all yellowfin tuna listed in paragraph (e) (2) (i) of the 40 CFR 56904, December 5, 1975, will continue to be subject to the importation restrictions of paragraph (e) (3) in 39 FR 32124, September 5, 1974, as amended. After May 31, 1977, all shipments of fish and products listed in paragraph (e) (2) (ii) of this section, from any nation, may not be unloaded into the United States unless a finding has been made pursuant to paragraph (e) (5) (i) below, and further, shall be denied entry into the U.S. unless accompanied by the following documentation: (i) A separate Yellowfin Tuna Certificate of Origin (Standard Form 370-1) from each country whose flag vessels caught yellowfin tuna involved in the importation. The Yellowfin Tuna Certificate of Origin must include the following information: (A) Country of origin of the fishing vessel(s) involved; (B) Exporter (name and address); (C) Consignee (name and address); (D) Identity and quantity of the yellowfin tuna to be imported, listed by U.S. Tariff Schedule Number; (E) Name of vessel(s) which caught the yellowfin tuna; (F) Fishing method used (i.e., purse seine, longline, pole and line, etc.); (G) Other documentation as may be required by the Director, subsequent to granting a finding in section (e) (5); (H) Must be signed by either a responsible government official of the country whose flag vessel caught the fish or the vessel master, below the following certification statements:

I certify that the yellowfin tuna described in (D) above was caught by flag vessels of a country either, (1) not required to obtain a finding from the United States Department of Commerce (National Marine Fisheries Service) under 50 CFR 216.24(e) (5), and the fish was not caught in a manner prohibited for United States fishermen by the United States Marine Mammal Regulations 50 CFR 216.24(d) (2); or (2) which has been found by the United States Department of Commerce (National Marine Fisheries Service) to be in conformance with the United States Marine Mammal Regulations 50 CFR 216.24(e) (5).

I certify that the above information is complete, true and correct to the best of my knowledge and belief. I understand that my making a false statement may subject me to the criminal penalties under the Marine Mammal Protection Act of 1972.

(i) Must also be signed by the exporter, under the following declaration:

The undersigned hereby declares that, based on the above statements, the yellowfin tuna herein offered for importation into the United States, was caught by flag vessels of (country), in conformance with the United States Marine Mammal Regulations 50 CFR 216.24.

(5) (i) After May 31, 1977, it shall be illegal to unload into the United States any tuna or tuna products in the classifications listed in paragraph (e) (2) (ii) of this section, from countries of origin (as documented under (e) (4) above) whose vessels operate in the yellowfin tuna purse seine fishery in the eastern tropical Pacific Ocean, as determined by the Director, National Marine Fisheries Service; unless the Director makes a finding in consultation with the U.S. Department of State, and publishes such finding in the FEDERAL REGISTER that fishing operations in the country of origin are conducted in conformance with U.S. regulations and standards as stated in paragraph (d) (2) of this section. The Director may make a finding that, although not in conformity with these regulations, such fishing is accomplished in a manner which does not result in an incidental mortality and serious injury in excess of that which results from U.S.

fishing operations under these regulations. Upon such a finding unloading may be allowed. Country of origin for the purposes of this section (§ 216.24(e)) shall mean the country under whose flag the fish catching vessels are documented and whose fish are a part of any cargo or shipment of fish to be imported into the U.S. regardless of any transshipments.

(ii) Countries of origin desiring to obtain a finding which will allow the importation of products listed in paragraph (e) (2) (ii) of this section must submit, by appropriate government official, to the Director, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce, Washington, D.C. 20235, the following information: (A) A statement of the quantity and type (identified by tariff schedule numbers listed in paragraph (e) (2) (ii) of this section) of fish or fish products expected to be imported into the U.S. in the calendar year 1977; (B) A detailed description of the fishing technology and procedures utilized in tuna purse seine fishing to protect marine mammals so that a determination of conformance with 216.24 (d) (2) of these regulations can be made, or the effectiveness of any other equivalent technology or procedures be assessed; (C) A statement of the number of marine mammals killed or seriously injured (by species) incidental to the yellowfin tuna purse seine operations on porpoise for the previous year, and the manner in which the information was obtained (logbooks, observers, interviews, or other procedures); (D) A statement of the number of marine mammals which will be allowed to be killed or seriously injured incidental to yellowfin tuna purse seine operations in 1977 and the impact of such mortality or serious injury on the existing populations of marine mammals by species; (E) A statement of the procedures to be required, including quotas and other controls, which will meet the U.S. requirements to limit the level of mortality, and procedures for prohibiting sets on marine mammals after the level of mortality allowed is reached; (F) Copies of laws and regulations which protect and conserve marine mammals involved in fishing operations; and (G) A list of vessels which may be involved in the taking of marine mammals incidental to yellowfin tuna purse seining, and a list of United States citizens working on these vessels. Should a finding be made, the Director intends to require a periodic update of the above list of U.S. citizens as a condition of the finding. The Director may require verification of statements made in connection with requests to allow importations. The Director will reconsider a finding upon a request from, and the submission of additional information from, the country of origin.

(6) Fish refused entry. If fish is denied entry under the provisions of § 216.24 (e) (3) or § 216.24(e) (4), the District Director of Customs shall refuse to release the fish for entry into the United States and shall issue a notice of such refusal to the importer or consignee.

(7) *Release under bond. Provided however.* That fish not accompanied or covered by the required documentation or certification when offered for entry may be entered into the United States if the importer or consignee gives a bond on Customs Form 7551, 7553, or 7595 for the production of the required documentation or certification. The bond shall be in the amount required under 19 CFR 25.4(a). Within 90 days after such Customs entry, or such additional period as the District Director of Customs may allow for good cause shown, the importer or consignee shall deliver a copy of the required documentation or certification to the District Director of Customs, and an original of the required documentation or a copy of the certification to the Regional Director of the National Marine Fisheries Service, unless the District Director of Customs has received notification from the National Marine Fisheries Service that the fish is covered by a certification. If such documentation, certification, or notification is not delivered to the District Director of Customs for the port of entry of such fish within 90 days of the date of Customs entry or such additional period as may have been allowed by the District Director of Customs for good cause shown, the importer or consignee shall redeliver or cause to be redelivered to the District Director of Customs those fish which were released in accordance with this paragraph. In the event that any such fish is not redelivered within 30 days following the date specified in the preceding sentence, liquidated damages shall be assessed in the full amount of a bond given on Form 7551. When the transaction has been charged against a bond given on Form 7553 or 7595, liquidated damages shall be assessed in the amount that would have been demanded under the preceding sentence under a bond given on Form 7551. Fish released for entry into the United States through use of the bonding procedure

provided in this paragraph shall be subject to the civil and criminal penalties and the forfeiture provisions provided for under the Act if (i) the required documentation or certification is not delivered to the Regional Director of the National Marine Fisheries Service within 90 days of the date of Customs entry, or such additional period as may have been allowed by the District Director of Customs for good cause shown, or (ii) the required certification is not on file in the office of the Director, National Marine Fisheries Service, Washington, D.C. 20235, within this 90 day period or such additional period as may have been allowed by the District Director of Customs for good cause shown. Fish refused entry into the United States shall also be subject to the civil and criminal penalties and the forfeiture provisions provided for under the Act.

(8) *Disposition of fish refused entry into the United States; redelivered fish.* Fish which is denied entry under § 216.24 (e) (3) or § 216.24 (e) (4) or which is redelivered in accordance with § 216.24 (e) (7) and which is not exported under Customs supervision within 90 days from the date of notice of refusal of admission or date of redelivery shall be disposed of under Customs laws and regulations. *Provided however,* That any disposition shall not result in an introduction into the United States of fish in violation of the Marine Mammal Protection Act of 1972.

(f) (1) The master of any commercial fishing vessel engaged in fishing operations for which a general permit is required shall, upon the proper notification by the Director as described in this section, allow an observer duly authorized by the Secretary to accompany the vessel on any or all regular fishing trips for the purpose of conducting research and observing operations.

(2) Research and observation duties shall be carried out in such a manner as to minimize interference with commer-

cial fishing operations. The navigator shall provide true vessel locations by latitude and longitude, accurate to the nearest minute, upon request by the observer. No owner, master, operator, or crew member of such vessel shall impair or in any way interfere with the research or observations being carried out.

(3) The Secretary shall provide for the payment of all reasonable costs directly related to the quartering and maintaining of such observers on board such vessels. The master or managing owner of each vessel who has been notified that he is required to carry an observer, via certified letter from the National Marine Fisheries Service, shall notify the field office, Southwest Region, National Marine Fisheries Service, San Diego, California, telephone (714) 293-6540 at least five days in advance of their fishing voyage to facilitate observer placement. No vessel whose master or managing owner has failed to comply with the provisions of this section may engage in fishing operations for which a general permit is required. Any person violating any of the provisions of this section shall be subject to the penalties provided in the Act.

(g) *Penalties and rewards:* Any person or vessel, subject to the jurisdiction of the United States shall be subject to the penalties provided for under the Act for the conduct of fishing operations in violation of these regulations. The Secretary shall recommend to the Secretary of the Treasury that an amount equal to one-half of the fine incurred but not to exceed \$2,500 be paid to any person who furnishes information which leads to a conviction for a violation of these regulations. Any officer, employee, or designated agent of the United States or of any State or local government who furnishes information or renders service in the performance of his official duties shall not be eligible for payment under this section.

[FR Doc. 77-5990 Filed 2-28-77; 8:45 am]

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric
Administration

MARINE MAMMALS

Incidental Taking in the Course of
Commercial Fishing Operations

On October 14, 1976, the National Marine Fisheries Service (NMFS) proposed regulations to govern the taking of marine mammals incidental to yellowfin tuna purse seining in 1977, and gave notice of a hearing thereon, 41 FR 45015-45019. The hearing was presided over by an Administrative Law Judge, the Honorable Frank W. Vanderheyden.

The Director, National Marine Fisheries Service, published in the *FEDERAL REGISTER* (42 FR 3886) that on January 18, 1977, he received a recommended decision from Judge Vanderheyden.

In accordance with the procedural regulations published at 41 FR 43550-43552 on October 1, 1976, the final decision and regulations governing the issuance of permits to allow the taking of marine mammals incidental to yellowfin tuna purse seining fishing in the eastern tropical Pacific Ocean and governing the importation of yellowfin tuna into the United States, are herein published.

The Final Supplemental Environmental Impact Statement (FSEIS) is being filed concurrently with the publication of these regulations. Consequently, these regulations will be final thirty days from the date the Final Supplemental Environmental Impact Statement is filed.

Applications for a permit will be entertained commencing with the date of publication. However, no permit will be issued until 30 days after the Final Supplemental Environmental Impact Statement is filed with the Council on Environmental Quality (CEQ). The date when the Final Supplemental Environmental Impact Statement (FSEIS) is filed will be announced in the *FEDERAL REGISTER*.

Dated: February 24, 1977.

ROBERT W. SCHONING,
National Marine
Fisheries Service.

DECISION IN THE MATTER OF THE PROMULGATION OF REGULATIONS AUTHORIZING THE ISSUANCE OF PERMITS TO ALLOW THE TAKING OF MARINE MAMMALS INCIDENTAL TO YELLOWFIN TUNA PURSE SEINING IN THE EASTERN TROPICAL PACIFIC OCEAN AND TO GOVERN THE IMPORTATION OF YELLOWFIN TUNA—DOCKET MMPAH #2-1976

BACKGROUND

On October 14, 1976, proposed regulations were published (41 FR 45015) pursuant to Section 103 of the Marine Mammal Protection Act (Act) to govern the taking of marine mammals incidental to yellowfin tuna purse seining activities under permits issued pursuant to Section 104, and to govern the importation of yellowfin tuna pursuant to Sections 101(a)(2) and 102(c)(3). The proposed

regulations were to replace regulations voided as contrary to the Act, 16 USC 1361, et seq. by the U.S. District Court for the District of Columbia (CA 74-1465, and CA 75-0227, filed May 11, 1976), and to amend import regulations.

The National Marine Fisheries Service determined that the proposed rules contained a major proposal requiring preparation of an Inflationary Impact Statement under Executive Order 11821 and OMB Circular A-107 and an Inflationary Impact Statement has been prepared. This determination is being reviewed in light of the final decision.

A Supplemental Draft Environmental Impact Statement to the Final Impact Statement filed on November 18, 1975 was made available to Federal Agencies and the general public for comment on November 12, 1976 (41 FR 50048). Comments on the Supplemental Draft Environmental Impact Statement were received from the Department of Labor, State of California Department of Fish and Game, Department of State, Department of the Interior, and Environmental Protection Agency. A final Supplement EIS will be filed with the Council on Environmental Quality concurrent with the publication of final regulations in the *FEDERAL REGISTER*.

In accordance with the Act, the proposals were the subject of a hearing on the record, presided over by an Administrative Law Judge (ALJ). The hearing was conducted in Washington, D.C., November 15, 16, 17, 18, and 19, 1976; San Diego, California, November 22, 23, 24, 26; and in Washington, D.C., November 28, 30 and December 1, 2, 3, and 4, 1976. Oral closing arguments were heard on December 22, 1976 in Washington, D.C. The hearing was conducted pursuant to expedited procedural rules published at 41 FR 43550, October 1, 1976.

The following parties participated at the hearing:

National Marine Fisheries Service; Marine Mammal Commission; Environmental Defense Fund, Alex Jay, American Littoral Society, Animal Protection Institute, Animal Welfare Institute, Connecticut Cetacean Society, Defenders of Wildlife, Environmental Policy Center, Friends of the Earth, Committee for Humane Legislation, Friends of Animals, Inc., Fund for Animals, Humane Society of the U.S., International Fund for Animal Welfare USA, National Parks and Conservation Society, The National Audubon Society, The Sierra Club, The Wilderness Society, American Tunaboat Association, Tuna Research Foundation; Zapata Ocean Resources Corporation; Pacific Legal Foundation; Fishermen's Union of America, Pacific and Caribbean Area AFL-CIO, The United Cannery and Industrial Workers of the Pacific; Commonwealth of Puerto Rico; Canadian Embassy, Department of State; and Japan Trade Center in New York.

The hearing focused on the following issues:

1. Estimated existing levels of the species and population stocks of the marine mammals involved in purse seining for yellowfin tuna;
2. The expected impact of the proposed regulations on the optimum sustainable populations of the species or population stocks involved;

3. The percentage of the initial unexploited species or population stock size which results in the maximum net productivity of the involved species and population stocks;

4. The economic feasibility of implementing the proposed regulations;

5. The technological feasibility of implementing the proposed regulations;

6. The rate of kill and total kill of the involved marine mammals by foreign countries;

7. The impact of the regulations on importation of yellowfin tuna and yellowfin tuna products;

8. The impact of implementing the proposed regulations on the tuna stocks.

CONSULTATION

The Act requires that I consult with the Marine Mammal Commission in promulgating regulations. The Commission was consulted prior to publication of the proposal and the Commission was a party to the proceedings. In addition, the Commission has filed exceptions, reply exceptions, and a letter from the Chairman, Dr. Douglas Chapman, which it has asked to be considered as satisfying its consultation right. It is my conclusion, therefore, that the consultative requirements of the Act have been satisfied. Additionally, as required by the conditions of the delegation of authority for decision making to me, I have consulted with the Administrator of the National Oceanic and Atmospheric Administration and the Secretary of Commerce on this decision with specific emphasis on the critical issues of depletion and quotas.

ALJ'S RECOMMENDED DECISION

The Administrative Law Judge (ALJ) recommended to me on January 17, 1977, based on reliable and probative evidence in the record as a whole, that the proposed regulations for the year 1977 be adopted as the final regulations, as amended by his findings of fact and conclusions of law. On January 21, 1977 (42 FR 3886) I notified the public of receipt of the Judge's recommended decision. I hereby adopted and incorporate by reference the Judge's decision except insofar as it is inconsistent with what is hereinafter set forth. In each instance where I make a specific determination, I will make reference to the decision of the Administrative Law Judge. Where appropriate, I will summarize the positions taken by other parties. In those instances in which I support the decision of the Administrative Law Judge, and the justification supporting such a decision in the recommended decision is persuasive and convincing, I will adopt both the decision and the rationale. Where I concur in the Judge's decision but wish to modify or add to the Judge's rationale, I will make appropriate comments.

DETERMINATIONS

In making my decision, Section 103(a) of the Act and the opinion of the U.S. District Court of the District of Columbia require that my decision be supported by the evidence on the record. That evidence is to be the best scientific evidence avail-

able. The public, including those government agencies with special expertise, was afforded an opportunity to participate and to introduce evidence at a formal hearing on the record. In view of this and after having reviewed the record, it is my conclusion that my decision is based on among other things the best scientific evidence available at this time and is supported by evidence on the record. I have determined that the proposal, procedures, and the decision satisfy the requirements of Section 1373 of the Act and the Court's opinion to make available to the public reasonable estimates of the existing population level of each species affected, the optimum sustainable population of each species, and the expected impact of the regulations on an optimum sustainable population for each species. As I understand the Act and the Court's opinion, I must be assured that the allowed taking will not be to the disadvantage of the marine mammals involved and is otherwise consistent with the purposes and policies of the Act, and I have so concluded.

DECISION CRITERIA

In framing the detailed decision which follows, a number of complex interrelated legal and scientific, particularly biological and statistical, subjects are addressed. These include marine mammal population levels, optimum sustainable population levels, depletion of stocks, mortality limits, and quotas derived from these limits. Although each of these subjects is individually covered in my decision, some overview of the background and the interrelationship of the factors considered is important in understanding the decision.

Population levels of the various species and stocks of marine mammals affected by the yellowfin tuna purse seine fishery were developed by a workshop of prominent scientists and extensively reviewed in the administrative hearing. While these population levels satisfy the criteria for population determination in the Act, it must be recognized that they are statistically determined mid-point levels. For stocks that have been little impacted by the fishery, these mid-point estimates are considered satisfactory. However, for decision purposes two other levels besides mid-point were determined. These have been termed the reasonably confident and virtually certain levels and represent levels of increasing confidence of 97.5 percent and 99.9 percent, respectively, that an individual species or stock is at or above the level indicated. Similar confidence levels, that is mid-point, reasonably confident, and virtually certain, have been applied to the net reproductive rate which provides a guide to whether individual stocks and species can sustain a measured level of mortality. The reproductive rate of a stock is important in determining historic population levels, the limit of take that can be allowed without disadvantage to the stock, and the optimum sustainable population.

POPULATION LEVELS

In the October 14, 1976 FEDERAL REGISTER notice of proposed regulations, as required by the Act (Section 103(d)(1)), I published a statement of the estimated existing levels of the species and population stocks. The Administrative Law Judge and all parties to the hearing who discussed species and stock size, except the American Tunaboot Association and Tuna Research Foundation and the unions, agreed with the accuracy of and underlying rationale for the stock size. The basic rationale comes from the "Report of the Workshop on Stock Assessment of Porpoises Involved in the Eastern Pacific Yellowfin Tuna Fishery" (Southwest Fisheries Center Administrative Report Number LJ-76-29). The population estimates in the record are updated to reflect information obtained since the workshop. A group of experts, including some with population dynamics expertise, was assembled by the National Marine Fisheries Service to conduct this workshop on porpoise stock assessment. The report contains estimates of existing population sizes, a determination of the levels of existing populations relative to optimum sustainable populations, and assessments of the im-

impact of various levels of incidental kill upon the existing population levels.

This report, which is a part of the record, assembled for the first time since the Act was enacted scientific information sufficient to make the determinations required by the Act for stocks of concern. The hearing record also includes testimony from a number of the workshop participants strongly supporting the workshop analyses.

The most significant criticism in the record of the workshop's product was from the industry and the unions. These groups alleged underestimations of populations based on a number of factors. However, the workshop participants had already considered many of the factors raised. In my opinion these groups did not successfully counter the testimony of workshop participants who testified at the hearing or the findings of the workshop on population sizes. Therefore, I conclude, as did the Judge, that the requirement of Section 103(d)(1) has been met. The population estimates for the relevant species are based on the best scientific evidence available and are as follows:

Species or stock— Management units:	Estimated population level ^a
Spotted dolphin (coastal)-----	(1)
Spotted dolphin (offshore)*-----	3,574,000
Spinner dolphin (Costa Rican)-----	(1)
Spinner dolphin (eastern)-----	1,292,000
Spinner dolphin (whitebelly)*-----	549,000
Common dolphin (northern)-----	400,000
Common dolphin (central)-----	230,000
Common dolphin (southern)*-----	800,000

^a Unknown.

* Including the tentatively identified southwestern stock.

* Including the tentatively identified southwestern stock.

* Including the tentatively identified Equatorial-Oceanic stock.

Species or stock— Management units:	Estimated population level
Striped dolphin (northern)-----	18,000
Striped dolphin (north-equatorial)*-----	230,000
Bottlenosed dolphin-----	588,000
Rough-toothed dolphin-----	450
Fraser's dolphin-----	7,800
Risso's dolphin-----	7,500
Short-finned pilot whale-----	60,000
Melon-headed whale-----	(1)
Pygmy killer whale-----	(1)

* Including the tentatively identified south-equatorial stock.

Source: 41 FR 45016 (Oct. 14, 1976).

OPTIMUM SUSTAINABLE POPULATION

A major issue involved in the hearing was the expected impact of the regulations on the optimum sustainable populations (OSP) of the species or population stocks involved. It is my duty therefore to make a determination regarding optimum sustainable populations and to be assured that the regulations being promulgated will maintain populations at or above optimum sustainable levels.

I have published a definition of optimum sustainable population (41 FR 55536). That definition is repeated here to facilitate the understanding of my decision. "Optimum sustainable population is a population size which falls within a range from the population level of a given species or stock which is the largest supportable within the ecosystem to the population level that results in maximum net productivity. Maximum net productivity is the greatest net annual increment in population numbers or biomass resulting from additions to the population due to reproduction and growth less losses due to natural mortality." The stock assessment workshop participants believed that the term maximum productivity should be interpreted as maximum net productivity. Maximum net productivity was interpreted and defined as being the lower limit of the range of OSP.

The workshop report cited a range of 50-70 percent as the lower bound of OSP; however, subsequent to the workshop some participants felt that a more definitive statement must be made and that 60 percent was a prudent approximation of a single value.

Testimony was presented which supported this range and both a 50 percent and 60 percent lower bound. The ALJ recommended that 50 percent be accepted. Some individuals and parties to the hearing, including the Marine Mammal Commission, recommended that the lower bound of OSP be set at 60 percent.

Based on these factors and following an in-depth review of the record and required consultation, I have decided not to adopt the ALJ's recommendation. It is my decision that the range of 50-70 percent best describes the lower bound of OSP that can be determined on the evidence available to date.

DEPLETION

A determination of depletion must in significant part be based on the optimum

carrying capacity and optimum sustainable population definitions, associated with depletion, in the Act.

Section 101(a)(3)(B) of the Marine Mammal Protection Act requires that, except for purposes of scientific research, no permit may be issued during the moratorium for the taking of any stock or species of marine mammals designated as depleted. Three tests are provided for determining depletion. One test is whether the number of individuals within a species or population stock is below the optimum carrying capacity for the species or stock within its environment. Optimum carrying capacity is a characteristic of the habitat. However, the definition of optimum carrying capacity refers to optimum sustainable populations which refers to the number of animals. Therefore, I have concluded as a matter of law that a species or stock is below the habitat's optimum carrying capacity when the number of individuals is below the optimum sustainable population, and consequently is depleted.

In my original proposal the eastern spinner dolphin was considered depleted. Although the hearing covered this question extensively, the subject of eastern spinner depletion was addressed principally in terms of the relation of its population to OSP. Thus the selection of a particular percentage as the lower bound of OSP was the key factor used by parties in recommending for or against depletion. However, there was agreement among all parties except the Committee for Humane Legislation and Friends of Animals that the stock of eastern spinner dolphins could withstand a take of about 6,500 because the population would still increase with virtual certainty.

The ALJ, having recommended that 50 percent be used as the lower bound of OSP, did not recommend that the eastern spinner dolphin be considered depleted. However, evidence presented during the hearing indicated that despite the eastern spinner dolphin population being at 54 percent of its initial stock size and within the 50-70 percent range, the probability of it being depleted was slightly greater than that of not being depleted.

Having reviewed the record, and in consideration of the probability of the eastern spinner dolphin being depleted and the recommendations of the Marine Mammal Commission, and after the required consultation with the Administrator of the National Oceanic and Atmospheric Administration and the Secretary of Commerce, I have decided not to adopt the Administrative Law Judge's recommendation and have determined that the eastern spinner dolphin population should be considered depleted at this time.

LIMITATIONS ON MORTALITY

The major issue involved in the proposal and in the record is the number

of marine mammals which could be incidentally killed in the course of commercial fishing, if permits were issued, and the resultant impact on optimum sustainable populations.

It was contended by the Committee for Humane Legislation that taking as defined in the Act includes all effects of fishing operations and is not limited to just mortality. However, as recognized by the Committee for Humane Legislation, the incidental take is addressed in the Act in terms of reduction of "mortality and serious injury." It is this context that is predominant in the final consideration. The provisions of the regulations are intended to reduce the total incidental mortality and serious injury. The regulations will allow incidental taking provided porpoise mortality does not exceed the quotas in the permit.

It was proposed by the National Marine Fisheries Service that individual limits on mortality be established under permit for 11 separate stocks or species with the sum of these limits totalling 29,920. The Marine Mammal Commission recommended 12 individual quotas totalling 50,158, plus an accidental mortality of 8,587 eastern spinner. The Environmental Defense Fund recommended 13 individual quotas totalling 53,120 including an accidental mortality of 6,500 eastern spinner. The Environmental Defense Fund and the Marine Mammal Commission recommendations concluded that, in the aggregate, a 1977 quota should be lower than the previous year's mortality in order to continue to reduce the mortality from year to year. The latest projected mortality on the record for 1976 is between 26,000 and 112,000. The Committee for Humane Legislation was opposed to any taking and did not make numerical recommendations other than zero. The American Tunaboat Association, Tuna Research Foundation, Fishermen's Union of America, Pacific Legal Foundation and Commonwealth of Puerto Rico recommended an aggregate quota of 96,100 with no individual species or stock limits.

The ALJ recommended a quota of 96,100, comprised of 13 separate stock quotas, concluding that separate quotas are required. I adopt the recommendation of the Judge that separate quotas are required. Ten of the quotas for "non-target" species are the same as NMFS proposed, based on the average take over the past five years, and were supported by all parties except the Committee for Humane Legislation. I have concluded that those ten quotas will not be to the disadvantage of those stocks and species and I have adopted the ALJ's recommendation of the taking of a total of 8,120 from those ten stocks. The ALJ's proposed quotas for these ten stocks and for the three major stocks involved in the fishing represent maximum biological limits of take for 1977. They are:

Species or stock—Management units:

Spotted dolphin (off-shore) ¹	64,393
Spinner dolphin (eastern)	6,587
Spinner dolphin (whitebelly) ²	17,000
Common dolphin (northern)	400
Common dolphin (central)	1,600
Common dolphin (southern) ³	5,600
Striped dolphin (northern)	40
Striped dolphin (northern-equatorial) ⁴	400
Bottlenosed dolphin	60
Rough-toothed dolphin	5
Fraser's dolphin	5
Risso's dolphin	5
Short-finned pilot whale	5
Total	96,100

¹ Including the tentatively identified southwestern stock.

² Including the tentatively identified southwestern stock.

³ Including the tentatively identified equatorial-oceanic stock.

⁴ Including the tentatively identified south-equatorial stock.

Source: 41 FR 45016 (Oct. 14, 1976).

It must be recognized that three levels of confidence were associated with the individual population estimates, reproductive rates, and the resultant calculations of allowable mortality found in the ALJ's recommended maximum limits. These levels which were extensively discussed on the record are (1) virtually certain, (2) reasonably confident, and (3) mid-point. In considering the record it is clear that the three major stocks are in different states of abundance and hence mortality limits should be established accordingly, that is, based on appropriate application of confidence levels related to the status of the separate stocks. The status of these three stocks relative to their initial stock size are:

	Percent
Offshore spotted dolphin	64
Eastern spinner dolphin	54
Whitebelly spinner dolphin	76

Since I concluded in my decision that the eastern spinner dolphin is depleted, no incidental take of the eastern spinner dolphin can be permitted even though about 6,500 could be taken with a virtual certainty that the population will increase with that level of mortality. For the whitebelly spinner dolphin, I have determined that, since the population is above the range of the lower bound of OSP, that is above 50-70 percent, a take at the mid-point level of 7,840 can be permitted and such take would not be to the disadvantage of the population. For the off-shore spotted, I have concluded that the record justifies the take be limited to a number less than allowable at the reasonably confident level but that such take could be greater than the virtual certainty level initially proposed. For that reason, I have determined that a take of 43,090 off-shore spotted dolphins, which is midway between these levels, would not be to the disadvantage of that stock. Although the limits I have

determined for the three major stocks differ from those recommended by the ALJ. I believe that the record, the finding of depletion for the eastern spinner porpoise, and the recommendations of the Marine Mammal Commission all support these limits.

In summary, I have accepted the ALJ's recommendations in part and, based on my review of the record and in consideration of the need to provide individual upper limits of allowable take for stocks and species that will not be to the disadvantage of them, have established the following upper limits of U.S. mortality for 1977.

Species or stock—Management units:

Spotted dolphin (off-shore) ¹ -----	43, 090
Spinner dolphin (whitebelly) ² -----	7, 840
Common dolphin (northern)-----	400
Common dolphin (central)-----	1, 600
Common dolphin (southern) ³ -----	5, 600
Striped dolphin (northern)-----	40
Striped dolphin (north equatorial) ⁴ -----	400
Bottlenosed dolphin-----	60
Rough-toothed dolphin-----	5
Frazer's dolphin-----	5
Risso's dolphin-----	5
Short-finned pilot whale-----	5
Total-----	59, 050

¹ Including the tentatively identified southwestern stock.

² Including the tentatively identified southwestern stock.

³ Including the tentatively identified equatorial-oceanic stock.

⁴ Including the tentatively identified south-equatorial stock.

Source: 41 FR 45016 (Oct. 14, 1976)

Permits, if and when issued, will limit taking by killing in the eastern tropical Pacific Ocean to those stocks and species listed above.

The order of the District Court pointed out that Section 1374(d)(3) of the Act imposes a burden on the applicant for a general permit to demonstrate in the application that the requested taking will be consistent with the Act and the applicable regulations. Therefore, unless otherwise indicated by the Court of Appeals for the District of Columbia Circuit, the final determination on permit issuance will be made following public review of a permit application and my review of the application, public comments, and the regulations.

QUOTA

As indicated in my decision regarding limitations on mortality, appropriate safety factors (confidence levels) have been applied to determine the allowable U.S. mortality on an individual stock basis. I have also concluded that the existing populations of marine mammals involved are at the mid-point level of confidence. Further, I consider the limitations on mortality established herein adequately recognize the mandate of the Act to reduce the incidental mortality and serious injury of marine mammals, as well as insure that the take will not operate to the disadvantage of the stocks and species involved. Therefore, in establishing a quota for 1977, no further re-

duction in the take levels beyond those already determined by the limitations on mortality is required.

The proposed U.S. quotas were developed by subtracting the estimated foreign mortality from a proposed total mortality by all fleets. Industry contended that it would be appropriate to apportion the quota by the ratio of the percentage of tuna caught on porpoise by U.S. and foreign vessels. The Judge found that the division of quota issue would appear to be moot, based on his recommended quota levels. Because I must be assured that the total mortality of individual species and stocks will not be to their disadvantage, I have considered the estimated foreign mortality in setting U.S. quotas.

OBSERVERS

Section 216.24(f) of the proposed regulations provided that observers could accompany tuna purse seine vessels for the purpose of conducting research and observing operations.

The Judge concluded that there exists no legal requirement on the part of the vessels to continue to permit observers to remain on board after quotas have been reached. I have adopted this conclusion and intend to place observers on vessels operated by certificate holders only while quotas remain in effect.

The Judge further recommended that regulations be amended to provide that observers shall have the opportunity to evaluate whether or not the certificate holder is performing according to the regulations.

Although I agree with its thrust, I have not adopted this recommendation since observer data collection procedures and forms for 1977 already include a provision for evaluation of the use or non-use of required gear and procedures, and accordingly, I consider additional regulations on this unnecessary. Since observer field record forms and procedures have been revised in consultation with the Marine Mammal Commission and the public, the concern of some parties to the hearing that observers would not record such information has been satisfied.

SKIPPER PANEL

There is considerable information in the record regarding use of a panel of expert skippers to evaluate the performance of skippers with respect to porpoise mortality. The Judge recommended that such a panel be established. There was general agreement, supported by the testimony of expert fishermen and industry leaders, that poor performers should be identified and corrective steps taken to reduce excessive mortality caused by less proficient certificate holders.

I have concluded that the holder of a general permit under the regulations shall establish a skipper panel for the purpose of making recommendations to the National Marine Fisheries Service. The general permit issued will include a requirement that the permit holder formulate a panel and advise the National Marine Fisheries Service of the members and the organizational rules

and procedures within 30 days of issuance of the permit. Upon formal recognition of the panel by the National Marine Fisheries Service, the panel will be expected to review the performance information from the observer logs and make recommendations to the National Marine Fisheries Service regarding each certificate holder's proficiency including, but not limited to, recommendations to suspend a certificate or for further training, as appropriate in each case. Recommendations of the skipper panel will be given great weight; however, final action will be the responsibility of the National Marine Fisheries Service.

SEVEN-DAY NOTICE

The Judge recommended that the National Marine Fisheries Service provide a 21-day notice in the *FEDERAL REGISTER* prior to the imposition of a prohibition of setting on porpoise. The industry supported a 30-day notice period. The Environmental Defense Fund advocated a 21-day notice period in order to minimize harm to the industry. The concern was that with only a 7-day notice as currently provided by the National Marine Fisheries Service, the fleet could be left with large operating expenditures paid in advance when an abrupt cessation of porpoise fishing was announced. This testimony was in the context of the 1976 season when an aggregate quota of 78,000 was reached in October and there was no advance notice that the quota was about to be reached. Fishermen contended that with a 7-day notice they did not receive adequate notice to plan or change their fishing strategy and it caused them economic harm.

However, receiving and analyzing observer data and publishing a *FEDERAL REGISTER* Notice requires a minimum of 15 days. With a 21-day notice period, the National Marine Fisheries Service would have to predict the closing of fishing on porpoise stocks at least 36 days before such a closing. Such a time frame will severely hamper the ability of the National Marine Fisheries Service to make reasonably accurate estimates of porpoise kill and to prohibit setting after a species or stock quota is reached. Because of the implementation of individual species/stocks limits in 1977 which will require precise monitoring and because the welfare of the porpoise is of prime concern, I have concluded that a 7-day notice in the *FEDERAL REGISTER* is appropriate.

I do realize the potential impact to the fleet of a 7-day notice period. To minimize this potential impact of the short notice period and to keep all interested parties advised of progress towards the limits imposed in a general permit, observers will submit radio reports semi-weekly and public notice of the estimated kill will be made available weekly, based on the prior week's radio reports and observer data from completed trips. This reporting procedure will also provide a better data base on which to base projections. Moreover, the methodology for computing the mortality has been revised in order to account for incomplete trip data which were previously excluded.

The proposed revised methodology will be published in the *FEDERAL REGISTER* for public comment.

Further, because the stocks of offshore spotted dolphin, whitebelly spinner dolphin, common dolphin (all stocks), and striped dolphin (all stocks) are the primary stocks and species involved, I have determined that setting on all stocks of porpoise during yellowfin tuna purse seining will be prohibited when quotas on the above species and stocks have been reached, notwithstanding the fact that the quotas on other species may not have been reached.

MIXED SCHOOLS SETS

In view of the depleted status of the eastern spinner and the establishment of individual stock and species quotas, additional prohibitions of sets on certain mixed and pure schools are required. Accordingly, I have determined that during yellowfin tuna purse seining, fishermen may not set on pure schools of eastern spinner, Costa Rican spinner, or coastal spotted dolphin or mixed schools which include these species, or pure schools of any other species except offshore spotted and common dolphin.

IMPORT PROVISIONS

The Judge discussed the import provisions of the proposed regulations extensively in his recommended decision and concluded, in sum, that with his suggested additions and changes, the import provisions are in agreement with the appropriate provisions of the Act and represent the most effective vehicle to obtain some control of porpoise mortality by foreign flag vessels. I have adopted his conclusions in my decision with certain exceptions.

I have adopted the Judge's recommendations regarding labeling of canned tuna as other than yellowfin, seeking a list of United States citizens crewing foreign seiners, and allowing a three-month grace period from the date of promulgation of final regulations before importation provisions become effective.

I have not adopted the Judge's recommendation to require a statement from nations requesting a finding concerning past enforcement actions under their laws and regulations. The intent of United States importation regulations is to establish a current set of requirements which the National Marine Fisheries Service will consider in determining other nations' compliance with our standards.

ECONOMIC AND TECHNOLOGICAL FEASIBILITY

I am required by the Act to consider the economic and technological feasibility of implementing the regulations.

Several witnesses testified and evidence was submitted regarding the technical feasibility of implementing the proposed gear modifications and fishing technique requirements.

Testimony from experienced and successful fishermen indicate that if the fishermen astutely practice the prescribed methods of reducing porpoise

mortality, the rate of kill, and consequently the total mortality can be reduced.

Industry representatives testified that the proposal to limit mortality to 29,930 of 11 separate stocks and species with the attendant prohibition on encircling mixed schools containing spinner porpoise would be economically disastrous to the industry.

I am convinced by the record and the Administrative Law Judge's recommendations that my initial proposal was more stringent than necessary to protect the species and stocks involved and that a virtual certainty finding on all stocks is not required.

The Administrative Law Judge concluded that the interests of the marine mammals should come first. However, I am required to also consider the economic feasibility of implementing the regulations. There are many uncertain and variable factors which affect the economic feasibility. Weather conditions, availability of other species of fish, business costs, prices of fish and normal business decisions all have an effect on the economic feasibility. The economic analysis which is part of the record indicates that the imposition of a quota below 80,000 will adversely affect the profitability of purse seiners, at least in the short run. Notwithstanding the impact of the even lower level set by this decision, the primary consideration must be the protection of the animals.

GEAR REQUIREMENTS

Several witnesses testified and evidence was submitted regarding the technical feasibility of implementing the proposed gear modifications and fishing technique requirements. On many of the proposed requirements there was no controversy. Thus, I adopt the proposed gear and fishing technique requirements except as noted below. However, even where I adopt a portion of my original proposal, I will discuss the issues involved where one or more parties disagreed with the proposal.

The evidence makes clear that a large proportion of porpoise mortality is caused when porpoise become entangled in the purse seine nets. The record also makes clear that the proposal for a 1½ inch mesh porpoise safety panel in the net can lead to a substantial reduction in porpoise kill. There was no disagreement over those facts and I adopt as did the Judge, this requirement with two minor exceptions. There was much testimony on the record concerning the amount of the 1½ inch mesh required on Class I and Class II vessels. The evidence shows that the proposed net requirements may not be fully adaptable to these vessels. The National Marine Fisheries Service in its brief, proposed an amendment to the proposed regulations concerning the amount of fine mesh net. The Judge adopted this revised proposal because he agreed that these vessels would have problems in complying with the proposed regulations requiring 180 fathoms of 1½ inch webbing. I adopt the Judge's recommendation.

There was general agreement that the entire fleet will not be able to obtain this fine mesh net in the early part of the year because of the inability of manufacturers to produce enough fine mesh net by the first of the year. The American Tunaboat Association, the Environmental Defense Fund, and the National Marine Fisheries Service submitted alternative proposals to allow fishing on porpoise without the fine mesh net under certain circumstances. I adopt the recommendation of the Judge that all boats must have ordered the fine mesh nets before they can fish on porpoise and that they have the webbing installed and inspected prior to departure on their next fishing voyage after delivery of the nets or 0001 hours, May 1, 1977, as the latest date for installation for vessels over 400 tons carrying capacity. In addition, I have concluded that vessel operators must document that they have ordered webbing if it has not been installed at the time they make application for a certificate of inclusion and to notify the National Marine Fisheries Service when the webbing has been delivered. I have added these requirements because they are consistent with the Judge's proposal and rationale and they help assure that these essential porpoise safety panels are installed as soon as possible.

The Judge recommended that regulations should require the use of speedboats and rescuers when backdown and release occur in darkness. Regulations already require their use on all sets and therefore this recommendation is already in effect and will remain so.

The Judge also recommended that all tuna boats be required to have floodlights and that such floodlights be used during the backdown procedures if sets occur in darkness. I adopt this proposal and the Judge's rationale. If backdown in darkness continues to cause higher mortality levels, NMFS will consider prohibiting sets which might not be completed prior to darkness.

One issue not addressed in the NMFS proposal was the use of a rubber raft and a facemask during backdown to aid in determining whether any live porpoise remain in the net and effecting their release. Use of such devices was proposed in the course of the hearing based on results of the *Elizabeth CJ* experimental gear/behavioral research. Such devices have not been subject to full field testing, but the American Tunaboat Association representatives raised no objection to the suggestion that these instruments be required. The Judge has adopted this suggestion and I adopt this recommendation and the rationale of the recommended decision with one exception. The Judge recommended use of a rubber raft with a glass bottom in lieu of a facemask. Such a device has not been adequately tested. Therefore, I have concluded that the use of a glass bottom raft or other means of underwater viewing is encouraged but will not be permitted in lieu of a facemask for this purpose.

The Judge recommended that all vessels have two speedboats regardless of

vessel class or observer status. The Judge found, and there was no disagreement, that the use of speedboats during back-down is essential for porpoise rescue. The NMFS proposal permitted Class I vessels having an observer to have only one speedboat in the water on porpoise sets because space limitations on these vessels preclude carrying an observer and sufficient personnel to operate two speedboats and perform other essential tasks. However, the Judge found the evidence as not convincing to show that an observer displaces a speedboat operator on all Class I vessels. Thus, he recommended two speedboats be in the water on porpoise sets on all vessels unless a certificate holder can show with certainty that the above described crewman displacement will occur. I adopt this recommendation and the Judge's rationale.

In summation, I find that these gear and fishing technique requirements are not only technically feasible and supportable on the record, but also essential to reducing porpoise mortality.

FOREIGN KILL

The best available estimate of the rate of kill by foreign vessels is that contained in the workshop report. The workshop decided to use an intermediate assumption that the non-U.S. kill rate for 1973-1975 was the same as the 1972-73 U.S. average, or approximately two and one-half (2½) times the current U.S. rate.

The estimated foreign kill was published in the supplemental EIS. Since those estimated levels of kill totalling approximately 41,000 were not disputed, it is concluded that those are the best available estimates of foreign kill.

IMPACT ON TUNA STOCKS—INTER-AMERICAN TROPICAL TUNA COMMISSION

There is testimony in the record that the limits proposed by the National Marine Fisheries Service would have an adverse impact on the tuna stocks. Section 103(b)(4) of the Act requires that I consider the effect on the conservation, development, and utilization of fishery resources. Testimony and evidence indicated that if the proposed quotas were implemented, there would be an adverse effect on tuna stocks as a result of fishing effort being shifted to non-porpoise associated fish, primarily in inshore areas. In general, non-porpoise associated tuna are young yellowfin. A concentration of fishing effort on these young fish would be harmful in the long-term.

The Administrative Law Judge found that the proposed regulations would result in a decline in the supply of all tuna, particularly yellowfin. Inter-American Tropical Tuna Commission (IATTC) regulations limit the take of yellowfin inside the Commission Yellowfin Regulatory Area (CYRA) to 15% following closure of the yellowfin quota. Unless a substantial reduction in mortality occurs, yellowfin fishing outside the Commission

Yellowfin Regulatory Area may be restricted by imposition of a prohibition on setting on off-shore spotted and whitebelly dolphin. When that occurs, fishing effort will be concentrated inside the Commission Yellowfin Regulatory Area. This concentrated effort will impact on the tuna stocks in inshore areas, however the impact is difficult to quantify.

MARINE MAMMAL LOGS

The proposed regulations direct certificate holders to maintain daily logs in a form prescribed by the NMFS of all sets in which marine mammals have been taken, together with other specified information including but not limited to, the actual count of marine mammals killed or seriously injured in any set. The Judge recommended that these logs be under oath in affidavit form because an affidavit will assure greater authenticity to such reports. I agree with the Judge that greater authenticity of the logs will result from affidavits. However, because many of the vessels return to foreign ports during the year, it would be impossible to obtain such affidavits within 48 hours after arrival of the vessels in port as is required by our regulations. Therefore, I have decided to require certified logs. A certification will be stamped upon the logs advising the signer that false statements may be subject to criminal penalties.

[FR Doc.77-5991 Filed 2-28-77;8:45 am]

APPENDIX IV

AGENCIES, ORGANIZATION, AND EMPHASIS

1.0 Statement on NSF Organization

The National Science Foundation was established in 1950 as one of the several independent agencies in the executive branch of the United States Government. The initial authorization was for the express primary purpose of funding basic research in all fields of science. Authorization has since been broadened to include applied research in science and engineering, and to provide funds for science education, science policy analysis, international programs, and science information activities.

The Foundation is organized into seven directorates including a Directorate for Research Applications which administers the Research Applied to National Needs (RANN) program. The RANN program of basic and applied research focuses scientific and technical resources on selected problems of national importance for the purpose of contributing to their timely, practical solution. Activities are organized around five problem areas: resources, environment, productivity, inter-governmental science and R&D incentives, and exploratory research and technology assessment. The RANN resources activity includes three program elements: resource systems, renewable resources, and non-renewable resources. The objective of the resource systems program

element is to identify and define the critical issues associated with the development, management, and utilization of natural resources.

With the exception of a few activities such as policy analysis and science resource surveys, the Foundation conducts no in-house research. Although principal investigators at academic institutions receive the major portion of funds awarded, support is provided for both basic and applied research conducted by industry, not-for-profit institutions, or individuals. Awards may be in the form of a grant or a contract. Grants are usually made in response to unsolicited proposals and represent the normal procurement mode. In cases where specific research objectives have been identified, solicited procurements in the form of requests for proposals, or program solicitations, are used. Awards made in response to solicited procurements may be in the form of either a grant or a contract.

Awards made through the RANN program address problems which share several characteristics in accordance with meeting the following criteria:

- 1) they have important national significance, 2) the payoff of research is expected to exceed significantly the costs of research on the problem,
- 3) the leverage of science and technology on the problem is substantial,
- 4) the efforts are timely and scientifically ready, 5) academic, industrial, and federal capability exists to mount a successful research program,
- 6) there is a need for federal action in that the regional research would

not likely be generated by normal market forces, 7) the Foundation is in a unique position to serve the objectives of the government in that the problem either overlaps the boundaries of several mission agencies, falls between the boundaries of the charters of mission agencies, or meets the longer range needs of one or more agencies. The Foundation's interest in the tuna/porpoise problem has been developed in accordance with these criteria.

2.0 The Marine Mammal Commission's Interest, Emphasis, and Plans for Research Related to the Tuna-Porpoise Problem

The Marine Mammal Protection Act of 1972 charges the Marine Mammal Commission with certain research and overview responsibilities related to all of the more than 100 species of marine mammals. The Act directs the National Marine Fisheries Service 1) to undertake a research program to reduce, to the maximum extent practicable, the incidental taking of marine mammals in connection with commercial fishing operations, and 2) to provide the data to assess the status of stocks impacted by commercial fishing operations.

The Commission, considering the resources available to the National Marine Fisheries Service to be inadequate to the task, has supported certain work in order to solve the problem more quickly. As a result, one-third of the Commission's 1976 research budget was spent on the tuna/porpoise problem. For example, the Commission provided: \$128,536

to Kenneth S. Norris, University of California, to undertake a behavioral research program; \$19,800 to the Naval Undersea Center to assess the acoustic characteristics of materials used in tuna purse seines; and \$29,650 to Progressive Fishing Enterprises to determine if solid polyvinyl panels--inserted in purse seines--might contribute to reducing incidental mortality and serious injury of porpoise. These and other Commission activities are summarized in its Annual Report to Congress, January 31, 1977, which is available from the Commission.

In 1977, the Commission again will expend a significant portion of its research funds on studies related to the tuna/porpoise problem. Persons interested in submitting proposals should request the "Guidelines for Proposal Submission" from the Marine Mammal Commission, 1625 Eye Street, N.W., Washington, D.C. 20006. As stated in the "Guidelines," applicants may, prior to submitting a formal proposal, send a proposal outline in the form of a two- or three-page letter. Such preliminary proposals will be reviewed and the applicant advised as to whether a full proposal would likely merit serious consideration for funding by the Commission. Proposals should be submitted by June 10 for consideration at the Commission's July 1977 meeting.

Decisions to provide or not to provide support will be determined according to the merits of the proposal and its potential contribution to furthering the purposes and policies of the Marine Mammal Protection

Act. Commission contracts are for periods up to 1 year; continued support may be provided after submission and review of a second formal proposal and an evaluation of the first year's work.

3.0 Porpoise Rescue Foundation Duties and Activities

The Porpoise Rescue Foundation (PRF) was formed in December 1975 to promote and support research, studies, education, training, and activities relating to reduction of porpoise mortality and serious injury in the course of fishing activities. Policy is set by the Board of Directors which consists of nine members: three representing the processors; three representing the producers and three representing labor. The operating manager is Living Marine Resources, Inc.

PRF's budget for fiscal year 1976 (December 1, 1975-November 30, 1976) was \$250,000, funded by equal contributions of \$125,000 each by the processors and the producers. The budget for fiscal 1976 was allocated to the purchase of gear and experimental equipment (67 percent) and scientific staff (33 percent).

PRF's budget for fiscal year 1977 (December 1, 1976-November 30, 1977) is projected to be \$351,000. It will be used for experimental ship time, purchase of experimental gear, the development of a training film and operator's manual, conducting gear workshops, the Captains' Panel and the scientific staff.

The activities of the PRF for fiscal 1976 may be conveniently placed in five categories:

1. Cooperative Program with NMFS, Southwest Region, to Place Observers on Vessels.
2. Gear Research to Reduce Incidental Porpoise Mortality.
3. Gear/Behavior Cruise on the Elizabeth C.J.
4. Expert Skippers' Panel
5. Cooperation with Other Organizations and Agencies

Activities planned for fiscal 1977 include:

1. Continued Cooperation in the Placement of Observers.
2. Mortality Reduction Tasks.
 - A Continued gear research with various fine-mesh systems.
 - B. Extension work with the fleet on a boat-by-boat basis, introducing the latest gear and techniques to be done in close cooperation with gear people at NMFS.

<u>Program</u>	<u>Amount</u>	<u>Comments</u>
Cooperative Gear Experiment with NMFS - Southwest Center		
Personnel	\$ 45,555	Salaries, overhead, travel, supplies sea pay premium, etc.
Gear Orientation	28,000	8 days at \$3,500. Extension training
Gear Experimentation	21,000	6 days at \$3,500. In cooperation with NMFS, gear modifications, techniques, etc.
Total	\$ 94,555	
Cooperative Observer Program with NMFS- Southwest Region		
Total	\$ 23,787	Scientific personnel, salaries, overhead, travel, supplies, etc.
Captains' Panel		Scientific personnel, overhead, meeting locations, supplies, etc.
Total	\$ 39,231	
Education, Fleet Extension, Public Service, Workshops, etc.		
Personnel	\$ 15,545	Salaries, overhead, travel, supplies, etc.
Operator's Manual	3,500	Estimate: art preparation, printing, etc., about 400 copies
Training Film	60,000	Two-three weeks' sea time, pro- fessional photography, script, editing, narration, etc. film clips, etc.
Workshops, etc.	2,500	Room rent, coffee, etc. (approx- imately six workshops).
Total	\$ 8,545	

<u>Program</u>	<u>Amount</u>	<u>Comment</u>
Behavior Studies		
Personnel	\$ 24,495	Salaries, overhead, travel, sea pay premium, supplies
Behavior - Open	30,000	Uncommitted funds - USC. Predicated upon results of 1976 cruise and consultation among NMFS, MMC and PRF as to priorities.
Total	<u>\$ 54,495</u>	
Cooperative Efforts with Other Agencies		
Total	\$ 27,387	Salaries, overhead, travel, supplies working in close cooperation with NMFS, NUC, universities, etc.
Contingency		
Total	<u>\$ 30,000</u>	Unforeseen - cooperative ventures, proposals, other equipment, acoustical work, etc.
Grand Total	\$351,000	

1/ No estimate has been made for the in-kind value of vessel sea time or crew time to modify the nets. It is assumed that the chance to take 1,000 tons of yellowfin within the CYRA (approximate value \$600,000) will be available in 1977. This is a contribution by the United States fleet.

- C. Gear workshops.
- D. Training film.
- E. Vessel operator's manual

3. Expert Skippers' Panel

- A. Preparation of statistics and trip-by-trip analysis for expert Skippers' Panel.
- B. Extensive interviews with skippers of high mortality vessels.

4.0 NMFS: Porpoise-Tuna Organization and Emphasis

The federal effort to confront the difficult ecological, economic and institutional problems associated with America's fisheries resides in the National Oceanic and Atmospheric Administration (NOAA), and its National Marine Fisheries Service (NMFS). The NMFS conducts biological research on economically important species, analyses economic aspects of fishery operations, develops methods for improving catches, and cooperates with the various states and the U.S. Department of State in national and international fisheries management.

One of four major fisheries research centers established in NMFS, the Southwest Fisheries Center (SWFC) is located in La Jolla, California. Guided by the basic principles of conservation and wise utilization,

the mandate of the SWFC is to conduct research to describe the various options for managing the Pacific coastal fisheries, the world tuna fisheries and eastern tropical Pacific porpoise populations, and to determine the future biological, environmental, economic and social impacts of these management options on the living resources of the sea. The SWFC is also mandated by the Marine Mammal Protection Act to reduce the incidental mortality of porpoise during fishing operations.

The SWFC Porpoise/Tuna Interaction Program is managed by John Everett and is one of the two branches of the Oceanic Division (William Fox, Chief). The four ongoing tasks of the Program are: 1) stock assessment, 2) mortality reduction, 3) quantitative analysis and data management, and 4) biological studies.

The NMFS, Southwest Regional Office in Terminal Island, California has established a field office on "B" Street Pier in San Diego, California. The goals of this office are to collect fisheries management data and monitor compliance as required by the Marine Mammal Protection Act of 1972.

APPENDIX V

GLOSSARY: TUNA SEINING TERMS

Apron: A trapezoidal appendage sewn to the top edge of the uppermost porpoise safety panel(s) of a purse seine. Before it can be installed the corkline must be cut from the safety panel. The corkline is subsequently re-attached to the sides (which are equilateral) and the top of the apron, the base of the apron having been attached to the safety panel. The apron produces a ramp-like, shallowing of the backdown area, reduces canopies, and reduces the incidence of tuna mixing with the porpoise in the release area during backdown.

Backing down: A process whereby the corkline of the purse seine can be submerged and pulled from under the porpoise with the application of reverse engine power by the seiner. This is a fundamental technique for releasing porpoise from the net. In 1976 about 97 percent of all porpoise captured were released by this method alone.

Bow bend: A term describing a normal configuration of the net which usually occurs during the pursing process. The net tends to wrap around the vessel and assume a kidney-like shape. That excess webbing (forming the bend around the bow) is normally pulled into bunches. This reduces the length of the corkline's perimeter, thereby diminishing the potential for net collapse and/or porpoise entrapment in this area.

Bow ortza: The end of the net located nearest the main bunt (sack) and porpoise safety panels. It is attached to the skiff when making a set.

Bow thruster: A propellor device located within the bow of many modern seiners that is used to push the bow to port or starboard. It is frequently used to control the relative position of the bow prior to and during backdown (this has a significant effect on the shape of the backdown channel).

Brailing: This refers to the process of moving the catch from the bunt to the deck level of the seiner. A small brailing net (1-1.5 ton capacity) is manipulated by men in the skiff and lifted using an auxiliary horizontal capstan and brailing boom.

Bridles: These are sections of chain (or Samson leadline) that are attached at both ends to the seine chain line. They are cut at a length that allows draping of the bridle below the chainline; a splitlink is attached at the center of the bridle and a pursing ring is tied to this link. (Also see towing bridles.)

Bunt: (sack) This is a portion of the net that is used to concentrate and raise the catch to the surface for loading. It is constructed of heavy, stronger twine in order to better accomodate the weight of large catches.

Bunches: These are large clumps of bunched corkline. They are pulled using an auxiliary bunch-line (like a draw string) that runs through small (~ 3 " diameter) rings which are tied to the corkline. Bunches are useful in 1) removing excess slack in the corkline (which can lead to canopies and entrapment) and 2) maximizing the bouyancy of the net going into the sacking-up phase (so as to prevent sinkage and loss of fish).

Canopy: This is a configuration where the webbing blossoms out beyond the corkline due to currents or other adverse conditions. Porpoise in canopies frequently can't find the way back to the surface to breathe due to the sometimes convoluted shape of the canopy. Canopies can also be caused by collapses, where the corkline comes together forcing porpoise into contact with the meshes and greatly reducing available surface area.

Centerpiece: This is the center portion of the pursing cable, and is generally heavier and larger in diameter in order to withstand the tremendous weight of the rings, bridles and chainline when they are lifted from the water to the ring stripper.

Chainline: This is a section of chain that runs the distance of the bottom of the net. It is attached to the selvedge on the lower edge of the bottom strips of webbing.

Choker winch: This is a small hydraulically operated winch located near the stern. It is loaded with a drum of Samson rope (choker line) and is used to tie-down the net for backdown and to lift and secure webbing during sacking-up operations.

Chute: This is a trapezoidal section of webbing with equilateral sides. It is located atop the apron, but below the corkline. It further optimizes the ramp formation characteristic of the apron. Additionally, it accelerates water flow (Venturi effect) over the corkline during backdown.

Collapse: This is a situation where the corkline comes together, restricting the porpoises' access to the surface. Severe collapse, involving large portions of the net can result in high porpoise kills. The timely use of speedboats pulling on towing bridles have proven to be effective as a preventive measure in reducing the incidence of collapse.

Da Rosa effect: This refers to a pre-backdown release phenomenon reported by the skipper of the M/V Evelyn Da Rosa. The vessels' Bold Contender System was modified at sea; this modification involved the removal of some of the corks from the corkline at the apex of the backdown area. Reportedly, porpoise escaped on a recurring basis, prior to backdown by swimming through the "scallops" that resulted from the cork removal.

Davit: This is an extremely sturdy device that is attached to the work deck, and hangs over the port edge of the seiner. It suspends the purse blocks which carry the load of the net during pursing.

Differential currents: An oceanographic condition where the surface current is running at a different speed and/or direction to the sub-surface current; this combination can significantly increase the incidence of canopy formation and net collapse.

Encirclement: This refers to the stage of the set where the target (either porpoise and tuna, schoolfish tuna, or log associated fish) is surrounded by the net or a combination of the net and towline.

Entanglement: This refers to porpoise being physically stuck to the webbing of the net (or to the corkline) by a part of their body such as snout, flippers, flukes or dorsal fin.

Entrapment: This refers to a situation within the seine where the porpoise are forced into contact with the webbing due to collapse or canopy formation.

Fine mesh: This term is used within the text of this report to specify 1 1/4 inch stretch mesh webbing.

Hang-in: This refers to a gathering-in process that is necessary to varying degrees when re-assembling a net that is having a Bold Contender or super apron modification installed. The combined length of the sides and top of the appendage(s) will always be larger than the original base-length of the apron. When the corkline is attached to the uppermost edge of the added appendage(s), the excess length of the perimeter must be gathered systematically. Unless the corkline is lengthened (infrequent) this increase must be proportionately gathered in to prevent canopy formation in the backdown area.

Medina panel: In the context of the report, this refers to a 2-inch mesh porpoise safety panel that is placed in the net to reduce porpoise entanglement during backdown. Generally one strip deep, it surrounds the apex of the backdown channel, the area where porpoise are most likely to come into contact with the net. Independently developed by tuna skipper Harold Medina in 1970, it was first used aboard the seiner Kerri M.

Mid net bunt: This is a bunt located on the rolling side of the mid net zipper. It is utilized only when the net is "cut" with the zipper, usually in sets with exceptionally large catches.

Ortza: This refers to either of the ends of the purse seine, which are reinforced. The typical seine net tapers up gradually from the maximum depth (generally 10-12 strips) to the pointed, wing-like ortzas.

Panel: A panel is a rectangular portion of the net composed of one bale of webbing. A fine mesh panel (1 1/4" stretch mesh) measures 60 fathoms by 5.9 fathoms; a 4 1/4" stretch mesh panel measures 120 fathoms by 5.9 fathoms. Note: the term "Porpoise Safety Panel" (PSP) sometimes refers to a combination of six bales of 1 1/4" stretch mesh webbing that measures 180 fathoms by 11.8 fathoms.

Pongo: See speedboats.

Porpoise rescue basket: This is a cage-like device designed to be hung over the side of the seine skiff during sacking-up operations in order to rescue porpoise from the sack.

Power block: This is a device, suspended from the main boom, which lifts the net from the water during the roll-net process. Generally, a hydraulically powered roller, its development made possible the handling of enormous nets.

Purse cable: This cable runs through the purse rings which are connected to the chainline by the bridles. By attaching both ends of this cable to the winch, the rings may be gathered and lifted to the boat. This closes the bottom of the net and precludes sub-surface escape.

Purse blocks: These are large blocks (pulleys) attached to the davit. The purse cable passes from the water, through the purse blocks, and onto the pursing drums of the winch.

Purse rings: The rings are attached to the bridles and are gathered by the purse cable. The use of rings permit the pulling and lifting force of the winch to be equally distributed around the chainline during pursing.

Pursing: The process of gathering and lifting the bottom of the net.

Reversed bunchlines: These are ropes that run through small rings which are attached to the corkline of the seine. At one end they are secured to the corkline; a small float is attached to the other end. These lines are ~50 fathoms long and are arranged so the floats of adjacent bunchlines are close together (~1 fathom). A speedboat can secure both end-floats of these lines and by pulling them away from the net effectively "hold" the net thereby preventing collapse in that area. The rings permit an even distribution of the speedboats pulling force along the corkline.

Roll-net: After the net has been pursed, the stern ortza is lead through the power block. The power block begins turning and lifting the net out of the water onto the seiner, where it is methodically stacked for the next set. The bow ortza is not rolled, rather it remains attached to the davit during roll-net operations. The net is rolled from the stern ortza until the catch is compressed due to the diminishing underwater volume within the net available to them; this results in the catch

being rolled into the sack (which is proximate to the bow ortza). In sets involving porpoise the net is rolled until the amount of net left in the water is proper for backdown. The roll-net process stops, the net is "tied-down", backdown takes place, and roll-net begins again.

Roll up: A roll up is a recurring type of malfunction that results in the delay of the set. The period of time needed to remedy the roll up varies as a function of its severity and can last from 5 minutes to 48 hours. Pursing of the net is slowed drastically or stopped completely. Canopy formation and/or net collapse may occur as a result of the delay if appropriate precautions are not followed. The use of speedboats pulling on the reversed bunchlines of the net has proven to be particularly effective in holding the net open and preventing further collapse in this situation.

A roll up occurs when tension induces twisting of the pursing cable causing it to literally roll up into the webbing at the bottom of the net. This results in the webbing becoming tightly wrapped around the pursing cable, bridles, chain line and rings. The rings no longer are able to evenly distribute the lifting and gathering force of the winch. The affected area of the net is lifted on the deck and the laborious ordeal of untangling the snarled conglomeration begins. This effort continues until it is possible to untangle the rings and cable to the extent necessary so that the net can be rolled. Frequently the rings are not put on the stripper but are freed one at a time from the pile on deck. About 6 percent of all sets experience rollups, about 5 percent of porpoise mortality is due to rollups.

Sack: The sack is another term for the bunt.

Sacking up: When the net has been rolled so that the fish are aggregated a lifting process begins where webbing is pulled over the rail of the seiner. The net is made more shallow by this process and the fish are further confined and trussed up to the surface where brailing can begin. Normally an auxiliary winch and a choker winch are used to hold the load of the fish being sacked up.

Selvedge: This is a reinforcement of the edges of the net. Extra strength twine is used to help prevent unraveling and tearing of the meshes. Selvedge strips are generally located directly below the corkline and directly above the chainline.

Skiff: The skiff is an auxiliary boat carried on the stern of the seiner. They are generally 20-25 feet long and have a beam of 15-18 feet. The skiff is used in three essential components of the set: 1) it holds the bow ortza during the setting or laying out of the net, making it possible to retrieve both ends of the net after encirclement, 2) it is used with a tow rope (generally polypropylene) to pull on the seiner and optimize its position relative to the net, and 3) it is used to sack up the catch, providing necessary flotation for the catch and a platform for the brailing operation.

Speedboats:(Pongos) The speedboats carried on seiners are generally 16-18 feet long with a single seat. They are powered by 45-80 horsepower outboard motors and are designed for high speed, open ocean operation. Speedboats are used for many different processes in the set, some of which include: 1) the chase and directing of the porpoise school prior to the set, 2) "patrolling" of the net after encirclement to keep porpoise away from hazard areas, 3) pulling on the net's reverse bunchlines or corkline to prevent collapses, 4) assisting in the process of pulling bow bunches by clearing the bunchlines and tangled corks, and 5) providing a platform for the hand release of porpoise throughout the set, but primarily during and after backdown. Normally tuna seiners utilize 4-5 speedboats in the course of a porpoise set.

Stern bend: This is a term describing the normal configuration of the net which usually occurs during the pursing process. The net tends to wrap around the vessel and assume a kidney-like shape. After the net is pursed, the skiff is normally used to pull the seiner out of the net, thereby diminishing the stern bend. However, the resultant "decay" of the bend frequently creates a problem area that must be watched carefully in order to prevent entrapment of porpoise and partial net collapse.

Stern ortza: This is the end of the net that is attached with the towline to the seiner during setting operations.

Stripper: The stripper is a sturdy hydraulically operated steel rod that is used to secure the purse rings after being lifted aboard the seiner. It facilitates the recovery of the seine by holding the rings in their proper sequence (i. e., the ring closest to the bow ortza is on the bottom, while the ring closest to the stern ortza is on the top; since the stern ortza is rolled first the rings slide off the stripper in the proper sequence.

Tie-down point: When a seiner prepares to backdown, both ends of the net must be secured in order to withstand the resultant load. Canopy formation is minimized during backdown if the proper amount of net between the outermost bunch and the stern is left in the water. This optimal condition can be attained on every set, if the tie-down points are marked. This can be done by painting the proper cork on the corkline (which is secured with the choker winch) and painting marks on the line controlling the outermost bunch.

Towing bridles: These are short sections of rope (usually nylon) attached to the transoms of the speedboats. A free sliding ring is attached to this rope and provides for convenient attachment to the reversed bunchlines.

Towline: The towline is attached to the stern ortza and permits retrieval of the ortza in sets where the circle described by the set has a longer circumference than the length of the net.

Winch: This refers to the large hydraulically operated main winch that is used to purse the net. It has three drums; one is used to retrieve towline, the other two control each end of the pursing cable.

Zipper: The zipper is used to "cut" the net in sets where the catch is too large to sack up in one bunt without risking a rip and loss of fish. "Cutting" the net with the zipper makes it possible to sack up twice. After making the cut, the fish are divided into two sections of the net, each with a bunt. Part of the catch can be sacked up and brailed aboard from the mid net bunt. After these fish are loaded this bunt is released. The remaining fish can be rolled to the main bunt and loaded in the normal manner.

The zipper is a line (usually Samson rope) that runs through small rings which are tied to the net. On one end it is attached to the corkline at midnet (a centerline bisecting the net vertically would touch the corkline at midnet). The other end is attached to the center of the chainline. When the rings have been loaded on the stripper, the chainline end of the zipper can be pulled. This divides the net (simply visualized as a hemisphere) into two hemispheres. The midnet corks are pulled to the boat and the net is bisected on a vertical axis.

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